ASSURED ACCESS TO SPACE: 1986

HEARINGS

BEFORE THE

SUBCOMMITTEE ON
SPACE SCIENCE AND APPLICATIONS

OF THE

COMMITTEE ON
SCIENCE AND TECHNOLOGY
HOUSE OF REPRESENTATIVES

NINETY-NINTH CONGRESS

SECOND SESSION

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*Ranking Republican Member.
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ASSURED ACCESS TO SPACE

WEDNESDAY, FEBRUARY 26, 1986

House of Representatives,
Committee on Science and Technology,
Subcommittee on Space Science and Applications,
Washington, DC.

The subcommittee met, pursuant to call, at 9 a.m., in room 2318, Rayburn House Office Building, Hon. Bill Nelson, (chairman of the subcommittee) presiding.

Mr. Nelson. Good morning.

The meeting will come to order.

We are going to have a continuation of the hearings that we started—rather lengthy hearings that were started last summer on the question of assured access to space. Little did we realize when we had those hearings last summer that the extreme importance of this question would be thrust upon us as it has been done so vividly and so rudely with this national tragedy that we all have suffered through.

But the fact is that having come through this national tragedy, one of the best things that we could do now in the memory of *Challenger 7,* who paid the ultimate sacrifice, is to do what they would want us to do and that is, to find the problem, to fix it, and move on.

I think that is a goal that all of us share. And so as we proceed toward that goal, one element of that goal is determining the necessary launch capacity that we're going to need as we look to the future, specifically the next 14 or 15 years, which gets us through the turn of the century, and then beyond.

Now, the hearings that we held last summer were hearings that we held jointly with the Research and Development Subcommittee of the Armed Services Committee, which had obvious reason to have the joint hearings with us.

We looked at such questions as the then four-orbiter fleet, how it could be utilized through the late 1980's and into the 1990's. We at that time encouraged the Department of Defense and NASA to start working together in an unparalleled cooperative effort in identifying the most cost-effective means of ensuring that we had the launch capacity that we need.

Now, those discussions have been going on frequently between NASA and the Department of Defense. They have had a series of formal and informal meetings and were at the point of starting to draw up some formal report right at the time of the tragic *Challenger* accident.

Let me state at the outset, you know the policy that this committee has set. I want all the members here present and any members that may join us to recognize the policy that has been set by this subcommittee and by Chairman Fuqua of the full committee, that we realize that the goal that we want is as speedy a resolution to this problem and we have determined that that can best be done not by having nine investigations going at the same time; rather that we are to cooperate and to assist the Presidential Commission as they go about the task of identifying what the problem is and then how to fix it.

Then at that point, once they have made that determination, if we so decide that we disagree with it or want additional information, we will conduct our own investigation. But up until that point, we are going to cooperate with them and not carry on some simultaneous investigation.

Thus, it is important for us here in this not to deal with the question of the accident and the investigation which is being handled by the Presidential Commission which, indeed, is meeting this morning, but rather, to stick to the subject matter which is the assured access to space.

Now there is a fine line there, I understand, and we'll just have to handle that as it comes along.

So today, we're going to hear the views of NASA and the Defense Department on the important subject of assured access to space.

Next week, we'll continue this set of hearings on assured access by hearing from commercial people.

I want to recognize our two witnesses. We're going to hear first from Dr. Bill Graham, the Acting Administrator of NASA, and then hear from Under Secretary of the Air Force, Pete Aldridge. I want to thank you all for being with us today and let's proceed.

[The prepared opening statement of Mr. Nelson follows:]

Opening Statement
# of the
Hon. Bill Nelson
February 26, 1986

Today we begin hearings on the subject of assured access to space.

The event that precipitated the need for these hearings was the tragic loss of the Orbiter Challenger and its brave crew of seven on January 28. As a Nation, we mourn the loss of these valiant men and women, but there is little doubt that the best tribute that we could pay them is to ensure that the program for which they sacrificed their lives continues to move forward.

A necessary step in that process will be to replace the space launch capacity that was lost through the destruction of Challenger. The focus of these hearings is how best to replace that lost launch capacity.

These hearings are an extension of the joint hearings that we held with the Armed Services Committee this past July. At that time, we were attempting to discover the best means of ensuring that the United States would have assured access to space throughout the 1990s.

At those hearings, the Subcommittee learned that user demand for space launches should reach a point that a four Orbiter fleet would be fully utilized by the late 1980s and could become over extended by the mid 1990s.

At that time, the Subcommittee also began encouraging NASA and the Defense Department to identify the most cost-effective means of ensuring that our space launch capacity would be adequate and flexible enough to accommodate the extended unavailability or total loss of a single Space Shuttle Orbiter with no major impact on the U.S. launch manifest of national security, civil government, foreign, and commercial payloads.

Unfortunately, the Administration and the Congress did not have sufficient time to identify and implement the best means of executing this policy before the occurrence of the tragic Challenger accident.

At this point, I would like to emphasize that at _no_ time during these hearings will we attempt to determine the _causes_ of the Challenger accident. We believe that it is more appropriate to leave that investigation up to the Presidential Commission, and then, after the Commission has filed its report, the full Committee will assess the situation following hearings that Chairman Fuqua will hold at the full Committee level.

Today we will hear the views of NASA and the Defense Department on these important subjects. Next week, we will hear from commercial expendable launch vehicle companies.

We had planned on having a session on private financing of a replacement orbiter on Tuesday, March 4. However, Mr. Willard Rockwell of Astrotech International has notified us that his firm has a conflict that they cannot reschedule and so they have requested that we reschedule at a later date. The Subcommittee will do all that it can to accommodate Mr. Rockwell's request. These hearings will thus continue on Thursday, March 6.

I would now like to recognize today's two witnesses. First we will hear from Dr. William Graham the Acting Administrator of the National Aeronautics and Space Administration. Then we will hear from the Under Secretary of the Air Force, Pete Aldridge.

Gentlemen, I would like to thank you for being with us today and for the testimony that you will provide.

But before receiving your prepared remarks, I would like to turn to Mr. Walker, the Ranking Republican Member of the Subcommittee, for any opening statement that he would like to offer.

Mr. NELSON. Dr. Graham.

Let me ask my colleague, my ranking member, Bob Walker, and ranking of the entire committee, Mr. Lujan. Would you prefer to go first or Bob?

Mr. LUJAN. Go ahead.

Mr. WALKER. Thank you, Mr. Chairman. I want to join you in welcoming the Acting Administrator, Mr. Graham, who is with us today and Under Secretary Aldridge before the committee.

Mr. Chairman, I realize Dr. Graham continues to be the subject of intense media interest in recent weeks. This committee is committed to waiting until the President's Commission has completed the investigation of the *Challenger* accident before we commence with our own review of the Rogers Commission findings and any necessary overview of NASA.

In the meantime, I want to commend Dr. Graham for the professionalism he has shown in his position. He came to NASA, was immediately thrown into the most difficult of all possible circumstances. His conduct as Acting Administrator has been exceptional.

Our witnesses today bring a chilling message. With the loss of the *Challenger* and the extended downtime required to complete the accident investigation, our space program is falling further and further behind.

At a time when Gramm-Rudman is placing the most stringent budget constraints in our history on Government spending, we are facing a total recovery cost of about $3 billion, and none of that was included in the President's budget. In fact, at this very moment, there is an effort underway in NASA to determine the full impact of the accident on the fiscal year 1986 and fiscal year 1987 budgets. We fully expect that NASA will come forward with a reprogramming request to reflect the fiscal year 1986 changes and with budget amendments to cover the expected fiscal year 1987 changes.

Mr. Chairman, it's too early for us to either speculate or reach conclusions about the cause or causes of the tragic loss of *Challenger*. That is an issue that we will explore at considerable depth later on this year.

But today marks a new beginning for our Space Program. The private sector has shown its support for programs and is indicating it may have a willingness to fund or replace an orbiter through private resources. This is a remarkable opportunity for the Congress and for the Nation.

In the wake of a tragic disaster, the people of the United States were quick to rally and there is now an opportunity to make a fundamental change in the manner that we procure our space hardware.

Over the next few weeks, we will hear from a variety of witnesses, including a number of high officials of NASA who will tell us that the time is right for private sector to become involved in the financing and procurement of the—of a replacement orbiter in the next generation of spacecraft.

I can foresee fleets of polar platforms, co-orbiting industrial facilities flying near the space station and even space-based electrical utility satellites all developed and paid for with private investments.

I can also say that as our witnesses today express the need for a continuation of existing ELV's, I can finally see a very real possibility for the true commercialization of ELV's. In years to come, it will finally be possible for American ELV manufacturers to maintain their industrial base with the Air Force and NASA contracts and to compete on a level field then with Ariane and other launch systems.

Mr. Chairman, the task before us is great. Let us move forward.

[The prepared opening statement of Mr. Walker follows:]

OPENING REMARK
REPRESENTATIVE ROBERT S. WALKER
FEBRUARY 26, 1986

GOOD MORNING, MR. CHAIRMAN. I WANT TO JOIN YOU IN WELCOMING ACTING ADMINISTRATOR GRAHAM AND UNDER SECRETARY ALDRIDGE BEFORE THE COMMITTEE TODAY.

MR. CHAIRMAN, I REALIZE THAT DR. GRAHAM HAS BEEN, AND CONTINUES TO BE, THE SUBJECT OF INTENSE MEDIA INTEREST IN RECENT WEEKS. THIS COMMITTEE IS COMMITTED TO WAITING UNTIL THE PRESIDENT'S COMMISSION HAS COMPLETED THE INVESTIGATION OF THE CHALLANGER ACCIDENT BEFORE WE COMMENCE OUR OWN REVIEW OF THE RODGERS COMMISSION FINDINGS AND ANY NECESSARY OVERVIEW OF NASA. IN THE MEANTIME, I WANT TO COMMEND DR. GRAHAM FOR HIS PROFESSIONALISM IN HIS POSITION. HE CAME TO NASA WITH LITTLE DIRECT EXPERIENCE, AND WAS IMMEDIATELY THROWN INTO THE MOST DIFFICULT OF ALL POSSIBLE CIRCUMSTANCES. HIS CONDUCT AS ACTING ADMINISTRATOR HAS BEEN EXCEPTIONAL.

OUR WITNESSES TODAY BRING A CHILLING MESSAGE. WITH THE LOSS OF CHALLANGER AND THE EXTENDED DOWN-TIME REQUIRED TO COMPLETE THE ACCIDENT INVESTIGATION OUR SPACE PROGRAM IS FALLING FURTHER AND FURTHER BEHIND.

AT A TIME WHEN GRANN-RUDMAN IS PLACING THE MOST STRINGENT BUDGET CONSTRAINTS IN OUR HISTORY OR GOVERNMENT SPENDING, WE ARE FACING A TOTAL RECOVERY COST OF ABOUT $3 BILLION AND NONE OF THAT WAS INCLUDED IN THE PRESIDENT'S BUDGET.

IN FACT, AT THIS VERY MOMENT THERE IS AN EFFORT UNDERWAY IN NASA TO DETERMINE THE FULL IMPACTS OF THE ACCIDENT UPON THE FY-86 AND FY-87 BUDGETS. WE FULLY EXPECT THAT NASA WILL COME FORWARD SHORTLY WITH REPROGRAMING REQUESTS TO REFLECT THE FY-86 CHANGES AND WITH BUDGET AMENDMENTS TO COVER THE EXPECTED FY-87 CHANGES.

MR. CHAIRMAN, IT IS TOO EARLY FOR US TO EITHER SPECULATE OR REACH CONCLUSIONS ABOUT THE CAUSE, OR CAUSES OF THE TRAGIC LOSS OF CHALLANGER. THAT IS AN ISSUE THAT WE WILL EXPLORE IN CONSIDERABLE DEPTH LATER THIS YEAR.

BUT TODAY MARKS A NEW BEGINNING FOR OUR SPACE PROGRAM. THE PRIVATE SECTOR HAS SHOWN ITS SUPPORT FOR THE PROGRAMS, AND ITS WILLINGNESS TO FUND A REPLACEMENT ORBITER THROUGH PRIVATE RESOURCES. THIS IS A REMARKABLE OPPORTUNITY FOR THE CONGRESS AND FOR THE NATION. IN THE WAKE OF A TRAGIC DISASTER THE PEOPLE OF THE UNITED STATES WERE QUICK TO RALLY AND THERE IS NOW THE OPPORTUNITY TO MAKE A FUNDEMENTAL CHANGE IN THE MANNER IN WHICH WE PROCURE SPACE HARDWARE.

OVER THE NEXT FEW WEEKS WE WILL HEAR FROM A VARIETY OF WITNESSES, INCLUDING A NUMBER OF HIGH FORMER OFFICIALS OF NASA WHO WILL TELL US THAT THE TIME IS RIPE FOR THE PRIVATE SECTOR TO BECOME INVOLVED IN FINANCING THE PROCUREMENT OF A REPLACEMENT ORBITER AND THE NEXT GENERATION OF SPACECRAFT.

I CAN FORESEE FLEETS OF POLAR PLATFORMS, CO-ORBITING INDUSTRIAL FACILITIES FLYING NEAR THE SPACE STATION, AND EVEN SPACE BASED ELECTRICAL UTILITY SATELLITES, ALL DEVELOPED AND PAID FOR WITH PRIVATE INVESTMENTS.

I CAN ALSO SAY THAT AS OUR WITNESSES TODAY EXPRESS THE NEED FOR A CONTINUATION OF EXISTING ELVS, I CAN FINALLY SEE A VERY REAL POSSIBILITY FOR THE TRUE COMMERCIALIZATION OF DOMESTIC ELVS. IN YEARS TO COME IT WILL FINALLY BE POSSIBLE FOR AMERICAN ELV MANUFACTURERS TO MAINTAIN THEIR INDUSTRIAL BASE WITH AIR FORCE AND NASA CONTRACTS AND TO COMPETE ON A LEVEL FIELD WITH ARIANNE AND OTHER LAUNCH SYSTEMS.

MR. CHAIRMAN, THE TASK BEFORE US IS GREAT, AND THE OPPORTUNITY TREMENDOUS. WE STILL MOURN OUR LOST HEROES AND HEROINES OF CHALLANGER. LET US MOVE FOREWARD WITH A RENEWED SENSE OF PURPOSE AND A REDEDICATION AS A NATION TO ONCE AGAIN REACH FOR THE STARS.

Mr. NELSON. Thank you, Mr. Walker.

Mr. Lujan.

Mr. LUJAN. Thank you very much, Mr. Chairman, and welcome, Dr. Graham, and Under Secretary Aldridge. I wish these types of hearings were not necessary, and we all wish that, but I guess we must continue on with the business.

Mr. Chairman, in light of the loss of the *Challenger,* these hearings and the issues which will be raised during the course of them are vitally important to the future of our Space Program and to our Nation.

With the loss of the *Challenger,* the Nation lost more than 25 percent of its launch capacity. This loss could not have come at a worst time for the 1986 launch schedule was the toughest one yet. We must find a way to begin to replace our lost launch capacity.

Today's hearing is the first critical step of that process. We must assess the capacity of a three-orbiter fleet and determine the size and the impact of the schedule disruption. Once we get an idea of the size of the backlog of payloads, we can then begin to discuss ways of handling that backlog. We can begin to discuss ways to regain our loss to assured access to space.

Mr. Chairman, in future hearings, we must address the question of the proper mix of expendable launchers and orbiters, as well as the implications that this loss will have on efforts to commercialize, as Mr. Walker has stated, private and/or privately financed, both expendables and orbiters.

It is essential that we address the issue of how it came to be, that in January 1986, our Nation found itself with all its eggs in one basket and no way to get to space.

As we revisit our notion of assured access to space, we must also refrain from making the same kinds of policy mistakes that have been made in the past when we actually promoted the exclusivity of the shuttle.

Clearly assured access to space means a reliable space transportation system involving many classes of vehicles and not just one class of vehicles.

In the past, NASA and the Department of Defense have not always shared the same concept of assured access. It's my hope that working together, our two most important players in the space arena can come up with ways to solve the array of problems, both of payloads and of launchers that the loss of the *Challenger* brings us.

As a committee, we need to look at these issues very closely and very carefully to get our Space Program back on track as fast as we can. And I thank you, Mr. Chairman.

[The prepared opening statement of Mr. Lujan follows:]

THE HONORABLE MANUEL LUJAN, JR.
OPENING REMARKS/SSA ASSURED ACCESS HEARING
FEBRUARY 26, 1986

MR. CHAIRMAN, IN LIGHT OF THE LOSS OF THE CHALLENGER, THESE HEARINGS AND THE ISSUES WHICH WILL BE RAISED DURING THE COURSE OF THEM ARE VITALLY IMPORTANT TO THE FUTURE OF OUR SPACE PROGRAM AND TO OUR NATION. WITH THE LOSS OF THE CHALLENGER, THE NATION LOST MORE THAN 25 PERCENT OF ITS LAUNCH CAPACITY. THIS LOSS COULD NOT HAVE COME AT A WORSE TIME, FOR THE 1986 LAUNCH SCHEDULE WAS THE TIGHTEST ONE YET. WE MUST FIND A WAY TO BEGIN TO REPLACE OUR LOST LAUNCH CAPABILITY.

TODAY'S HEARING IS THE FIRST CRITICAL STEP OF THAT PROCESS. WE MUST ASSESS THE CAPACITY OF A THREE-ORBITER FLEET, AND DETERMINE THE SIZE AND IMPACT OF THE SCHEDULE DISRUPTION. ONCE WE GET AN IDEA OF THE SIZE OF THE BACKLOG OF PAYLOADS, WE CAN THEN BEGIN TO DISCUSS WAYS OF HANDLING THAT BACKLOG. WE CAN BEGIN TO DISCUSS WAYS TO REGAIN OUR LOST "ASSURED ACCESS" TO SPACE.

IN FUTURE HEARINGS, WE MUST ADDRESS THE QUESTION OF THE PROPER MIX OF EXPENDABLE LAUNCHERS AND ORBITERS, AS WELL AS THE IMPLICATIONS THAT THIS LOSS WILL HAVE ON EFFORTS TO COMMERCIALIZE, PRIVATIZE AND/OR PRIVATELY FINANCE BOTH EXPENDABLES AND THE ORBITER.

ABOVE ALL, IT IS ESSENTIAL THAT WE ADDRESS ISSUE OF HOW IT CAME TO BE THAT IN JANUARY OF 1986, OUR NATION FOUND ITSELF WITH ALL ITS EGGS IN ONE BASKET AND NO WAY TO GET TO SPACE. AS WE REVIST OUR NOTION OF ASSURED ACCESS TO SPACE, WE MUST ALSO REFRAIN FROM MAKING THE SAME KINDS OF SPACE POLICY MISTAKES THAT WE HAVE MADE IN THE PAST WHEN WE ACTIVELY PROMOTED THE EXCLUSIVITY OF THE SHUTTLE. CLEARLY, ASSURED ACCESS TO SPACE MEANS A RELIABLE SPACE TRANSPORTATION SYSTEM, INVOLVING MANY CLASSES OF VEHICLES, NOT JUST ONE CLASS OF VEHICLE.

IN THE PAST, NASA AND THE DEPARTMENT OF DEFENSE HAVE NOT ALWAYS SHARED THE SAME CONCEPT OF ASSURED ACCESS. IT IS MY HOPE THAT, WORKING TOGETHER, OUR TWO MOST IMPORTANT PLAYERS IN THE SPACE ARENA CAN COME UP WITH WAYS TO TO SOLVE THE ARRAY OF PROBLEMS, BOTH OF PAYLOADS AND LAUNCHERS, THAT THE LOSS OF THE CHALLENGER BRINGS US.

AS A COMMITTEE, WE NEED TO LOOK AT THESE ISSUES VERY CAREFULLY TO GET ON SPACE PROGRAM BACK ON TRACK AS FAST AS WE CAN.

Mr. NELSON. Thank you, Mr. Lujan.
Dr. Graham.

STATEMENTS OF WILLIAM R. GRAHAM, ACTING ADMINISTRATOR, NASA, ACCOMPANIED BY ADMIRAL RICHARD TRULY, ASSOCIATE ADMINISTRATOR FOR SPACE FLIGHT AND CHESTER LEE, DIRECTOR, CUSTOMER SERVICES; AND HON. EDWARD C. ALDRIDGE, UNDER SECRETARY OF THE AIR FORCE, DEPARTMENT OF THE AIR FORCE, THE PENTAGON

Dr. GRAHAM. Mr. Chairman and distinguished members of the subcommittee, I appreciate the opportunity to discuss with you today some of the issues and longer range alternatives that we must address as a result of the loss of the *Challenger.*

The tragedy of January 28, when *Challenger* was destroyed shortly after liftoff, reminds us in the cruelest possible way that the exploration and the exploitation of space is not without risk, risk not only to people and machines, but to the spirit to persevere in the face of adversity. The greatest tragedy, however, would be that the loss of the *Challenger* and its crew would undermine our national will to solve the problems that have been presented, to confront new challenges and, to continue to open the frontiers of science and technology. The President has said that we will go forward with the shuttle program and the national response to the *Challenger* accident has been overwhelmingly in favor of going forward.

NASA's first priority has always been and will continue to be safe and successful shuttle flights. It is because of this safety priority that we fully support the Presidential Commission investigating the STS 51-L accident and are continuing our review and analysis of the data pertaining to the accident. To date, we have found several possible elements, events, and conditions which may have a bearing on the cause. None of these directly point to the orbiter itself, which appears, in fact, to have functioned properly.

With the loss of the *Challenger,* we have lost one-quarter of our shuttle fleet and are in a temporary hiatus in shuttle flights. We are in the process of reviewing the entire launch manifest and all the payloads to see what means can be identified to regain the launch capability that we hope to achieve with the four-orbiter fleet. Let me emphasize that we are considering all options in this process. But it is certain that we will have a shortfall in the national launch capability in the near term. Making up that shortfall and trying to make sure that we have a broad-based national space program is essential. Until the outcome of the accident investigation is known, we will not know precisely when we will be able to launch our next shuttle mission or be able to predict accurately all of the related manifest changes. We're examining delays to the next shuttle launch of 6, 12, and 18 months, and have at this time established a 12-month baseline, giving first priority to critical national security payloads, then to scientific payloads with specific launch windows and finally to other U.S. Government, foreign and domestic commercial payloads. The possible manifests are being worked jointly with the Department of Defense [DOD].

Mr. Chairman, the administration, through the interagency process, is considering the broadest possible range of options, including the use of commercial expendable launch vehicles. The President has previously stated his strong support for the development of CELV's—that is, complementary, expendable launch vehicles—by the Department of Defense and for the private-sector development of a commercial, expendable launch vehicle capability.

We hope to see the United States establish a healthy, viable, and competitive commercial ELV capability that will be able to place in orbit commercial payloads that do not require the shuttle's capabilities. There will be a transition period while that commercial capability becomes viable, but we hope that the transition will be as short as possible. One of the problems that we've encountered is marrying the capability and availability of expendable launch vehicles to existing payloads. To date, we've identified two Delta launch vehicles which were previously assigned that might be used for other payloads if the Deltas were then replaced in a timely manner.

There are also three partially assembled Delta vehicles which could be used for replacement and for an additional payload sometime in the 1987 or 1988 timeframe. Generally, however, it would probably be 24 to 36 months before additional Delta vehicles would be available.

Looking beyond the shuttle system, we hope to have a new technology for orbiter ascent by the end of the next decade; that is, the end of the 1990's or soon thereafter, but until that new capability is fully available, we will need the shuttle system.

Clearly we cannot rely on one system for maintaining the assured access to space that this Nation requires. For at least the next 3 years, we'll be limited to a three-orbiter fleet that will have a backlog of payloads which will need to be launched during that time. A 3-orbiter shuttle fleet and associated infrastructure will give us the capability to launch only 16 to 18 shuttle flights per year. We also cannot preclude the possibility of removing an orbiter from the flight schedule for an extended period of time for unanticipated maintenance.

Mr. Chairman, the combination of adequately sized shuttle and CELV fleets appears to offer the best and most effective approach through at least 1995. There should also be a promising opportunity for domestic commercial ELV enterprises during this time to assume both the risks and the rewards of competition in the commercial market.

The United States has a number of expendable launch vehicles which have been or were being phased out as payloads for transition to the shuttle and to the CELV's. These vehicles, which include Deltas, Scout, and Atlas Centaur, could be used to supplement the shuttle in delivering payloads. The DOD is also carefully looking at a number of CELV's, their production, performance, and requirements for use. With the production turn-on, a launch readiness for the first eight Delta vehicles could be achieved in about 24 months with a rate of about one every 2 months after that.

Mr. Chairman, we have a number of decisions to make that bear upon the mix and use of various launch vehicles and on the options available to the Nation. NASA, in conjunction with other governmental agencies, is considering the broadest possible range of options and alternatives available. There will certainly be a shortfall in the national orbiter launch capability in the near term and we are looking at every possible way to minimize that shortfall.

Mr. Chairman, this is the end of my prepared testimony. After remarks by Under Secretary Aldridge, I would appreciate the opportunity to answer any questions that you may have.

[The prepared statement of Dr. Graham follows:]

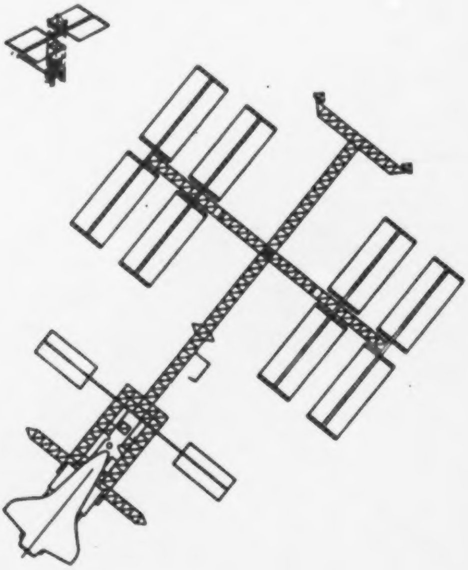
NASA
National Aeronautics and
Space Administration

Hold for Release Until
Presented by Witness

February 26, 1986

Subcommittee on Space Science and Applications
Committee on Science and Technology

House of Representatives



Statement by:

Dr. William R. Graham
Acting Administrator

99th Congress

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PRESENTED BY WITNESS

February 26, 1986

Statement of

Dr. William R. Graham
Acting Administrator

National Aeronautics and Space Administration

before the

Subcommittee on Space Science and Applications
Committee on Science and Technology
United States House of Representatives

Mr. Chairman and Distinguished Members of the Subcommittee:

I appreciate this opportunity to discuss with you today some of the issues and longer range alternatives that we must address as a result of the loss of the Challenger.

The tragedy on January 28, when Challenger was destroyed shortly after liftoff, reminded us in the cruelest possible way that the exploration and exploitation of space is not without risk, risk not only to people and machines, but to the spirit to perservere in the face of adversity. The greatest tragedy, however, would be that the loss of Challenger and its crew would undermine our national will to solve the problems that have been presented, to confront new challenges, and to continue to open the frontiers of science and technology. The President has said that we will go forward with the shuttle program and the national response to the Challenger accident has been overwhelmingly in favor of moving forward.

NASA's first priority has always been and will continue to be safe and successful shuttle flights. It is because of this safety priority that we fully support the Presidential Commission investigating the STS 51-L accident and are continuing our review and analysis of the data pertaining to the accident. To date, we have found several possible elements, events and conditions which may have a bearing on the cause, but none of these directly point to the orbiter itself which appears to have functioned properly.

With the loss of Challenger, we have lost one quarter of our shuttle fleet and are in a temporary hiatus of shuttle flights. We are in the process of reviewing the entire launch manifest and all of the payloads to see what means can be identified to regain the launch capacities that we had hoped to achieve with the four orbiter fleet. Let me emphasize that we are considering all options in that process.

But it is certain that we will have a shortfall in the national launch capability in the near term. Making up that shortfall and trying to make sure that we have a broad-based national space program is essential. Until the outcome of the accident investigation, we will not know precisely when we will be able to launch our next shuttle mission or be able to predict accurately all of the related manifest changes. We are examining delays to the next shuttle launch of six, twelve and eighteen months and have at this time established a twelve month baseline, giving first priority to critical national security payloads, then to scientific payloads with specific launch windows and finally to other U.S. Government, foreign and domestic commercial payloads. The possible manifests are being worked jointly with the DOD.

Mr. Chairman, the Administration, through the interagency process, is considering the broadest possible range of options including the use of commercial expendable launch vehicles. The President has previously stated his strong support for the development of CELV's by the Department of Defense and for private sector development of a commercial ELV capability.

We hope to see the U.S. establish a healthy, viable and competitive commercial ELV capability that will be able to place in orbit commercial payloads that do not require the shuttle's capabilities. There will be a transition period while that commercial capability becomes viable, but we hope that the transition time will be as short as possible. One of the problems that we have encountered is marrying the capability and availability of ELVs to existing payloads.

To date, we have identified two Delta vehicles, which were previously assigned, that might be used for other payloads if the Delta's were then replaced in a timely manner. There are also three partially assembled Delta vehicles which could be used for replacement and for an additional payload sometime in 1987 or 1988. Generally, however, it would probably be 24 to 36 months before additional Delta vehicles would be available.

Looking beyond the shuttle system, we hope to have a new technology for orbital ascent by the end of the next decade or soon thereafter. But until that new capability is fully available, we will need the shuttle.

Clearly, we cannot rely on one system for maintaining the assured access to space the Nation requires. For at least the next three years we will be limited to a three orbiter fleet and will have a backlog of payloads which will need to be launched during that time. A three orbiter shuttle fleet and associated infrastructure will give us the capability to launch only 16 to 18 shuttle flights per year. We also cannot preclude the possibility of removing an orbiter from the flight schedule for an extended period of time for unanticipated maintenance.

Mr. Chairman, the combination of adequately-sized shuttle and CELV fleets appears to offer the best and most effective approach through at least 1995. There should also be a promising opportunity for domestic commercial ELV enterprises during this time to assume both the risks and the rewards of competition in the commercial market.

The United States has a number of expendable launch vehicles which have been or were being phased out as payloads were transitioned to the shuttle and the CELVs. These vehicles, which include Delta, Scout, and Atlas Centaur, could be used to supplement the shuttle in delivering payloads. The DOD is also carefully looking at a number of CELVs, their production, performance and requirements for use. With a production turn-on, a launch readiness for the first of eight Delta vehicles could be achieved in about 24 months, with a rate of one every two months after that.

Mr. Chairman, we have a number of decisions to make that bear upon the mix and use of various launch vehicles, and the options available to the Nation. NASA, in conjunction with other governmental agencies is considering the broadest possible range of options and alternatives available. There will certainly be a shortfall in the national orbital launch capability in the near term and we are looking at every possible way to minimize the shortfall.

Mr. Chairman, this is the end of my prepared testimony. I appreciate this opportunity to appear before you today and would be pleased to answer any questions you may have.

####

Mr. **Nelson**. Thank you, Dr. Graham.

Mr. Aldridge.

Mr. **Aldridge**. Thank you, Mr. Chairman.

I also appreciate the opportunity to be here before this committee, although I wish it were under happier circumstances. In fact, I wish I were here trying to defend a need for ELV's to complement an existing four-orbiter fleet as I have done for the last 2 years.

Unfortunately, recent events have confirmed the need for ELV's and the need for a mixed fleet of launch vehicles. This requirement no longer is an insurance policy, as it once was claimed by many of its critics.

The issue whether or not we need ELV's no longer exists. The issue now is what is the most appropriate national space launch posture.

The *Challenger* accident highlighted the vulnerability of our reliance on a single space transportation system for all U.S. space access regardless of redundancy in high reliability. However, this accident should in no way question the value or success of the STS program and the unique capability that it offers to the Nation.

The objective of our recovery strategy should be to learn from this tragic lesson and rebuild a stronger and more balanced national capability that is largely independent of failures of a given system.

We must structure our Space Program so that both the national launch capability and Manned Space Flight Program are strengthened and more focused as a result of this experience.

As a result of the *Challenger* loss, the Nation is now faced with an orbiter fleet down until an appropriate fix to the problem can be implemented and estimates run between 6 months and 2 years for that downtime.

A 3-orbiter fleet to fly an anticipated 24 flights per year. Only two of those orbiters, *Discovery* and *Atlantis*, are capable of flying the heavier DOD payloads. A growing backlog of shuttle missions, DOD as well as civilian, resulting from the downtime and from only having a three-orbiter fleet.

As a result of congressional approval of the CELV's and Titan II space launch vehicles, our ELV industry is now capable of providing additional ELV launch capability in a little over 2 years. We also have the capability to build a replacement orbiter in 3 to 4 years.

The seriousness of the impact to DOD of this tragedy to a great extent depends on the downtime of the orbiter fleet and what actions we take now to recover our space launch capability.

If the downtime is on the order of 6 months—I think an optimistic viewpoint at this point—the near-term effect will be relative minor with only minor perturbations in our launch schedule.

The midterm result—that is, over the next 2 to 3 years, is more serious since we estimate that by 1989, we could have as many as 15 to 20 equivalent shuttle missions backlogged.

Unless we obtain another orbiter by that time, the backlog could grow at a rate of six per year. If the STS were down for a year or more, there are much more serious—more serious near- and midterm impacts.

Ten DOD payloads will be delayed from launching during the next year. There will be a significant increase in the backlog of 20 to 30 equivalent shuttle flights during—prior to obtaining the increased launch capability in 1989.

There would be heavy impact on NASA missions because many of the backlogged DOD payloads—DOD missions—must take priority when the flights are reinstituted.

If the downtime were 2 years, DOD would have serious problems with 21 high-priority payloads waiting on the launch pad for a launch opportunity. During this 2-year period, over 35 shuttle missions would have to be canceled to be rescheduled for a later time.

Unfortunately, there is no alternative to alleviate the DOD launch requirements during the next 2 years. We must simply live with the delays incurred.

As you can see, there is great incentive to find the problem and fix it as expeditiously as possible, but it must be done correctly. Unless we take immediate corrective action to restore our launch capability in the longer term, the longer term impacts could be much more severe.

There are two approaches we could take to launch future DOD payloads. In the first approach by fully exercising DOD priority, we might be able to live with a three-orbiter fleet as a result of our bumping rights. This would minimize the costs to DOD for alternate launch means, but would have a major impact on non-DOD missions.

In the second approach, we could obviously attempt to minimize the impact to NASA by offloading to the maximum extent DOD payloads to expendable launch vehicles. This would significantly increase the cost to the Department of Defense.

The obvious choice is to attempt a balanced approach. The balanced approach would maintain the DOD shuttle missions where it makes sense to do so and offloading some DOD shuttle payloads to ELV's where it also makes sense. The payloads removed would be ones that could be shifted to ELV's without excessive cost or delays.

This balanced approach is more—is most attractive from a national perspective. Based on our preliminary assessment, we can remove a few DOD payloads from the shuttle manifest in the future to help NASA maintain a viable civil, foreign, and commercial launch capacity and yet fully meet DOD launch requirements and launch demands.

This offload would cause us to maintain the manufacturing capability through the mid-1990's, to increase the number and launch rate for CELV's beyond our current plan of 10 vehicles launching at a rate of 2 per year.

To continue to modify and launch the Titan II beyond the 13 vehicles included in our current plan and continue to build and launch the existing ELV's, Atlases, and/or Titan 34D's. The details of this plan are currently being worked jointly with NASA.

DOD will still be heavily dependent on the shuttle and will require about four to six launches a year from the fleet. DOD's view is that the requirement for the procurement of a replacement orbiter must be based on the overall manifest requirements. However, it is not clear that the current three-orbiter fleet can meet the demands of both NASA and DOD and if the maximum flight rate of the three remaining orbiters cannot be sustained, we cannot satisify national launch requirements.

DOD would strongly encourage the procurement of a replacement orbiter now to regain the fleet launch capacity and to ensure that we can more easily and competently meet the demanding launch requirements of our future space programs.

To summarize, Mr. Chairman, the near-term impact on DOD starts becoming severe if the orbiter fleet is down for more than a year. There is no recovery option that will mitigate this impact within the next 2 years. We must procure and launch additional ELV's beyond our current plans and procure a replacement orbiter if we are to confidently meet our future space launch needs. We must take this action now to minimize the negative long-term impacts of the orbiter loss. It is our intent that our recovery plan be a joint DOD–NASA plan.

Thank you, Mr. Chairman. I can respond to any questions you may have.

[The prepared statement of Mr. Aldridge follows:]

DEPARTMENT OF THE AIR FORCE

PRESENTATION TO THE
HOUSE SCIENCE AND TECHNOLOGY COMMITTEE
SPACE SCIENCE AND APPLICATIONS SUBCOMMITTEE

26 FEBRUARY 1986

STATEMENT OF: HONORABLE EDWARD C. ALDRIDGE, JR.
UNDER SECRETARY OF THE AIR FORCE

NOT FOR PUBLICATION UNTIL RELEASED
BY THE COMMITTEE ON SCIENCE AND
TECHNOLOGY
HOUSE OF REPRESENTATIVES

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE:

I appreciate the opportunity to appear before you, although I wish it were under happier circumstances. In fact, I wish that I were here trying to defend the need for ELVs to complement an existing 4 orbiter fleet—as I have done for the last 2 years.

Unfortunately, recent events have confirmed the need for ELVs and the need for a mixed fleet of launch vehicles. This requirement no longer is an "insurance policy" as it once was claimed by many of its critics. The issue of whether or not we need ELVs now no longer exists. The issue is what is the most appropriate national space launch posture.

The Challenger accident highlighted the vulnerability of our reliance on a single space transportation system for all U.S. space access regardless of redundancy and high reliability. However, this accident should in no way question the value or success of the STS program and the unique capability that it offers the nation. The objective of our recovery strategy should be to learn from this tragic lesson and rebuild a stronger and more balanced national capability that is largely independent of failures in a given system. We must structure our space program so that both the national launch capability and manned spaceflight program are strengthened and more focused as a result of this experience.

As a result of the Challenger loss, the Nation is now faced with:

- An orbiter fleet down until an appropriate fix to the problem can be implemented—estimates of the down time run between 6 months and 2 years

- A three orbiter fleet to fly an anticipated 24 flights per year. Only two of those orbiters, Discovery and Atlantis, are capable of flying the heavier DOD missions

- A growing backlog of Shuttle missions—DOD as well as civilian—resulting from the down time and from only having a three orbiter fleet.

As a result of Congressional approval of CELVs and TITAN II space launch vehicles, our ELV industry is now capable of providing an additional ELV launch capability in a little over 2 years. We also have the capability to build a replacement orbiter in 3 to 4 years.

Near-Term Impacts

The seriousness of the impact to DOD of this tragedy to a great extent depends on the down time of the orbiter fleet and what actions we take now to recover our space launch capability.

If the down time is on the order of 6 months, the near-term effect will be relatively minor, with only minor perturbations in our launch schedule. The mid-term result, through 1988, is more serious, since we estimate that by 1989 we could have as many as 15 to 20 equivalent Shuttle missions backlogged. Unless we obtain another orbiter by that time, the backlog could grow at a rate of at least 6 per year.

If the STS were down for a year or more, there are much more serious near- and mid-term impacts.

- Ten DOD payloads would be delayed from launch during the next year
- There would be a significant increase in the backlog to 25 to 30 equivalent STS flights prior to obtaining increased launch capability in 1989
- There would be a heavy impact on NASA missions because many of the backlogged DOD missions must take priority when the flights are reinstituted.

If the down time was 2 years, DOD would have serious problems with 21 high priority payloads waiting on the launch pad for a launch opportunity. During this 2-year period, over 35 Shuttle missions would be cancelled.

Unfortunately, there is no alternative to alleviate the DOD launch requirements during the next 2 years. We must simply live with the delays incurred.

As you can see, there is a great incentive to find the problem and fix it as expeditiously as possible, but it must be done correctly.

Longer-Term Impacts

Unless we take immediate corrective action to restore our launch capability the longer-term impacts could be much more severe.

There are two approaches we could take to launch future DOD payloads. In the first approach, by fully exercising DOD priority we might be able to live with a three orbiter fleet as a result of our bumping rights. This would minimize the cost to DOD for alternate launch means but would have a major impact on non-DOD missions. Or in the second approach, we could obviously attempt to minimize the impact to NASA by off-loading to the maximum extent DOD payloads to ELVs. This would significantly increase the cost to DOD. The obvious choice is to attempt a more balanced approach.

- The balanced approach would maintain the DOD Shuttle missions where it makes sense to do so, and off-loading some DOD Shuttle payloads to ELVs where it also makes sense. The payloads removed would be ones which could be shifted to ELVs without excessive costs or delays.

This balanced approach is most attractive from a "national" perspective. Based on our preliminary assessment, we can remove a few DOD payloads from the STS manifest in the future to help NASA maintain a viable civil, foreign, and commercial launch capacity and yet fully meet DOD launch demands. This off-load requires us to maintain the manufacturing capacity through the mid-1990s to:

- Increase the number and launch rate for CELVs beyond our current plan of 10 vehicles launching at a rate of 2 per year

- Continue to launch the Titan II beyond the 13 vehicles included in our current plan

- Continue to launch the existing ELVs; i.e., ATLAS and/or TITAN 34D.

The details of this plan are currently being worked jointly with NASA.

The Need for a Replacement Orbiter

DOD will still be heavily dependent on the Shuttle and will require about 4 to 6 launches per year from the fleet.

DOD's view is that the requirement for the procurement of a replacement orbiter must be based on the overall manifest requirements. However, it is not clear that the current three orbiter fleet can meet the demands of both NASA and DOD and, if the maximum flight rate of the three remaining orbiters cannot be sustained, we cannot satisfy national launch requirements.

DOD would strongly encourage the procurement of a replacement orbiter now to regain the fleet launch capacity and to ensure that we can more easily and confidently meet the demanding launch requirements of our future space programs.

Summary

To summarize, Mr. Chairman:

- The near-term impact on DOD starts becoming severe if the orbiter fleet is down for more than 1 year. There is no "recovery" option that will mitigate this impact within the next 2 years.

- We must procure and launch additional ELVs beyond our current plans and procure a replacement orbiter if we are to confidently meet our future space launch needs.

- We must take this action now to minimize the negative long-term impacts of the orbiter loss. It is our intent that our recovery plan be a joint DOD/NASA plan.

Mr. **Nelson**. Thank you, Mr. Aldridge.

Dr. Graham, you just heard Mr. Aldridge say that DOD strongly encourages the procurement of a replacement orbiter. What does NASA feel?

Dr. **Graham**. Mr. Chairman, in all of our analyses and review to date one signal comes through very strongly and that is that there is a very strong requirement for a replacement of the capability of the orbiter that was lost and a replacement of that by replacing the orbiter itself that was lost in the accident.

The infrastructure for operating a four-orbiter fleet is largely in place. The manifest that required a four-orbiter fleet has been a part of our space policy and space planning for many years and, therefore, it appears at this point that there is a very strong case to be made for a replacement orbiter for the *Challenger*.

Mr. **Nelson**. I might just share with you some of my personal experience as you continue to deliberate on that particular item.

Mr. Aldridge made reference to the fact, I think you did also in your testimony, if you had any additional downtime on one of the three remaining orbiters that we have, it could be something as, as minor, although it would end up being more major if, for example, on a landing we had a collapse of a landing gear which would cause some damage to one of the three orbiters, you know, I have an enormous amount of respect for the professionalism of those people who fly those orbiters. I mean they are the best of the best, but there is no room for error. When the commander takes over control at about 50,000 feet and it glides like a rock and he's aiming with a 17- to 22-degree glide scope, which is basically hurtling toward the Earth aiming at the aim lights 7,500 feet back from the end of the runway, he's, well all of them have been right on the money. They are right on the mark because they are so good, but there is no room for error. It's conceivable in the future that you wouldn't, you wouldn't settle down at less than 1 foot per whatever the period of time is that those guys do, just settling it in just light as a feather, and a strut could break, and so we would end up with considerable downtime and then we would have two orbiters, two orbiters to do everything else that we have to do and I take it by both of your testimony that that would be just unacceptable in terms of what we have to have of assured access to space. Am I stating that fairly accurately?

Mr. **Aldridge**. In my opinion, you are. As a matter of fact, you don't even have to point to the orbiter, the fleet, the shuttle carrier aircraft could have a damaged landing gear and could not bring this orbiter back from Edwards. You have single threads throughout the system that need, that need to be looked at.

Dr. **Graham**. Mr. Chairman, I think that the Nation has before it a question concerning the fundamental space program that it wishes to carry out and whether it wishes to have in the future a space program which is subject to very major disruption and very major delay based on the loss or even the, damage, or some potential problem on one element in that program.

Right now we have a space program which is programmatically fragile. It was in a delicate state before the *Challenger* accident. It is in a more delicate state by far today because, as you accurately observe, anything that would delay the use of one of the remaining three orbiters, even within the timeframe that we are looking at now, but certainly beyond that, would cause major disruptions and very substantial delays and changes without alternative for the United States.

I think the question before the country is, Do we wish to go into the future with the Space Program which is liable to major disruptions from basically unanticipated sources or do we wish to have a space program that is sufficiently viable and sufficiently broad based that we can continue it no matter what difficulties we encounter within the bounds of any possibility?

Mr. NELSON. Mr. Aldridge brought out another point that had come so clearly out of the hearings last summer which was the 747 aircraft. There is only one of those and if you had significant downtime on it, you can't transport your orbiters back and forth across the country, and so that's just as good as having an orbiter down. So, it's time for us to get on with making some of the hard choices here.

Both of you also made reference to the new technologies that are being looked at. I would like for you to state for the record here the fact of where you see the research and development proceeding as to when we could have an operational, if the technologies prove themself, a new operational fleet of a next-generation of space transportation system or aerospace plane. There's been some confusion in the press as to specific dates on that. Would either of you like to comment on that?

Dr. GRAHAM. Mr. Chairman, NASA jointly with other Government agencies, particularly the Department of Defense, is conducting a study now of capabilities beyond the generation of the current shuttle fleet. We are looking at 1995 and beyond in the general context of that study and there are a number of possibilities within that timeframe for additional lift capability that would enhance the existing and what we hope will be the reconstituted shuttle fleet.

One of the technologies we're looking at very carefully is the National Aerospaceplane technology, sometimes called the Transatmospheric Vehicle [TAV] technology. This would be a marriage of rocket technology and jet engine technology into a craft which could, in fact, use the oxygen in the atmosphere during its ascent, take off approximately like a normal aircraft and yet fly directly to orbit or if it made a different trajectory stay in the upper reaches of the atmosphere and, as the President mentioned in the State of the Union, cover enormous transcontinental distances in a period of a very few hours.

We think that the technology is maturing to the point that that will become a viable option in the foreseeable future. I would hope that that capability will be balanced off and is certainly being worked within NASA and within the Department of Defense against rocket technology, as such, which will also advance very substantially during this period of time and we've actually got a race, a competition going on internally between a pure rocket technology and an air-breathing transatmospheric technology and I don't know where it's going to come out, but I am very optimistic about the results in both.

However, I think it is likely that that will not become a viable operational system until approximately the year 2000, perhaps a little bit beyond that, but in that timeframe and that means we have at least 14 years of operation of the existing shuttle fleet before we get to that capability and while we are pushing that as hard as we can, you'll see that there are more things to be done in that and more technologies to be developed and I don't think it's a viable option for much in advance of the end of the 1990's.

Mr. **Nelson**. Do you concur in that, Mr. Aldridge?

Mr. **Aldridge**. Yes, Mr. Chairman, I sure do. There have been people who speculate that why don't we accelerate the aerospaceplane to take up the slack in the orbiter as a result of the orbiter loss. That option just does not exist. It is our view that it's in the year 2000 timeframe before this technology would be, prove out to be a valid alternative, and we do have problems to solve right now long term before that technology comes to pass.

Mr. **Nelson**. All right, now, in, in trying for us to determine when the existing fleet of three orbiters might be available, obviously it's going to all depend on, on the Commission identifying what the problem is, and getting on with it, but right now for your planning purposes you were using basically a year, is that correct Dr. Graham?

Dr. **Graham**. We're using that for a baseline, Mr. Chairman, and if you like I'll go into the reason for that. We are also considering excursions of 6 months and 18 months.

Mr. **Nelson**. All right, and you set out your timetable very well that if its 6 months this is one scenario regarding the DOD, but if you go beyond a year then you run into increasingly complex complications.

Mr. **Aldridge**. Beyond a year it becomes painful. We think we can live still painful during any period, but we believe we can live with a less than a year it would be very fortunate if we could get the next shuttle off within, before that year was up, but we're, we're supporting the NASA view in trying to get our flights up as early as we can, but it's going to have to wait on the accident before we can really precisely say how long it will be.

Mr. **Nelson**. I know that a number of these questions that you will have from the committee are speculative, but I don't know how other that we can ask them and it is important as we examine assured access to space that we start this dialog.

Now, let's assume that the fleet of orbiters are now operational. Do you have any idea about what would be the likely launch rate per year, once we are back in business and going? Aside from the question of a replacement orbiter, I am talking about the existing three, what would you see the likely launch rate to be for the subsequent 3 years?

Dr. **Graham**. Mr. Chairman, we are working on a planning basis of 9 launches during the first 12 months that we would return to space flight, 14 launches the second 12-month period after return to flight operations, and then going to a 16- to 18-flight-per-year launch rate in the third 12-month period and then thereafter.

And, Mr. Chairman, if I may, I would like to introduce Adm. Richard Truly and Mr. Chester Lee and ask them to join me at the table and see if they have any further comments. Admiral Truly is the head of our Office of Space Flight and the Associate Director for Space Flight, having been named to that position last week, and very generously provided to NASA by the Navy and the Department of Defense.

Mr. Lee is the head of our Manifesting Operation inside the Office of Space Flight and will have more details on some of these topics.

Do either of you have any specific comments on the buildup rate issue?

Mr. **Nelson**. We welcome you all and welcome back to the team, Admiral Truly.

Admiral **Truly**. Thank you, Mr. Chairman.

Mr. **Nelson**. Did you have anything you wanted to add, Mr. Aldridge?

Mr. **Aldridge**. No.

Mr. **Nelson**. OK. Now, then, having said that estimate, and we appreciate it, that is the kind of information that we need to start talking about. All right, now, are you assuming, Dr. Graham, that all three are operating out of the Kennedy Space Center or are you assuming that one of them is going to be operating under that scenario that you just laid out of Vandenberg Air Force Base.

Dr. **Graham**. That scenario is a combination of operating from the Kennedy Space Center in Florida and from the western test range at Vandenberg Air Force Base, Mr. Chairman.

As you realize, I am sure, we value greatly the western test range operational base and, in fact, that is the only base from which the shuttle can reach polar or high inclination orbits. At the same time we also realize that operation in two different bases necessarily puts longer turnarounds in our operation, and so we have a balance to strike between the convenience of operation at one base and the access to different orbits in different regions of space that we get from two bases.

Mr. **Nelson**. All right. Now, what happens to your likely launch rates if the opposite scenario were to be the case that instead of launching out of Kennedy and Vandenberg, you're just launching out of Kennedy?

Dr. **Graham**. Let me defer to Mr. Lee, who does our manifest planning, if I may, and then Mr. Aldridge may also have some comments.

Mr. **Lee**. Mr. Chairman, as Dr. Graham indicated, we have been examining the questions in cooperation with the Department of Defense. Now, there are some scenarios where conducting flight operations from Vandenberg and Kennedy would be optimum and we would not increase the flight rate.There are other scenarios where we might increase the flight rate by one or two flights which can or cannot be significant.

Mr. **Aldridge**. We have been exploring this issue of Vandenberg with our "what if" analyses. The options tend to focus on how long again do you think you're going to be down. If we are down for only 6 months we would not propose any major changes to our plans at Vandenberg; we would fly out of Vandenberg as quickly as we could. If the orbiter is down for more than a year, and I say more because a year kind of is the break point, if it's down for more than a year then there are serious questions as to whether or not one would fly the first missions out of Vandenberg to try to say 1 year or 2 years to downtime. One could consider putting those vehicles on expendable launch vehicles. That requires you really to be down for more than 2 years. Two years, of course, was roughly the time that we were down when we had the inertial upper stage failure. We were 21 months between failure and reflight, but if you're talking about being down for less than a year, our strong indications are we should press on with keeping Vandenberg as close to schedule as we can make it within the constraints of the orbiter fleet.

We do know that that places concerns and constraints on the turnaround time, but the missions that are flying out of Vandenberg are extremely important and their priority should weigh in with determining the manifest and in the launch rate that we can achieve.

Mr. NELSON. All right. Before our Members share in this dialog, let me just get some basic statistics down.

Of the three orbiters, you only have one left that can carry Centaur, is that correct?

Dr. GRAHAM. That's correct, Mr. Chairman. However, last week I gave instructions to proceed with the modification of one of the other orbiters, the *Discovery,* to fit it for operation of the *Centaur,* and that's in train now and we believe that will be completed during the time that we are returning to flight operations.

Mr. NELSON. All right. Of the three, what are the payloads weights that they can carry?

Dr. GRAHAM. Two of them, Mr. Chairman, the *Discovery* and the *Atlantis,* have a maximum payload weight of 65,000 pounds into orbit from the Kennedy Space Center. That is a low inclination orbit.

The third one, the *Columbia,* was an earlier model of the space shuttle. It is structurally at a greater weight and, therefore, has a lesser payload by approximately 7,000 pounds and so would go to about 58,000 pounds maximum.

Mr. NELSON. Are there any other distinguishing characteristics of the orbiters that the committee needs to know as we continue this dialog with you?

Mr. ALDRIDGE. I think I mentioned in my testimony that, in our opinion, for the DOD payloads, the heavier DOD payloads, that only *Discovery* and *Atlantis* with the modifications for *Centaur,* are really capable of launching the heavier DOD payloads, either out of ETR or WTR.

Some of the smaller DOD payloads, *Discovery,* I mean *Columbia,* could launch, but we don't believe it could launch the heavier ones out of the western test range.

Mr. LEE. May I just add, Mr. Chairman, in our manifesting we support Secretary Aldridge; we do not use the heavier vehicle for the DOD payloads.

Mr. NELSON. Admiral Truly, you flew first on *Columbia* and you're last flight was on *Challenger.*

Admiral TRULY. Yes, sir. I flew STS-2 aboard *Columbia* and commanded STS-8 aboard *Challenger.*

Mr. NELSON. OK.

Mr. Walker.

Mr. **Walker**. Thank you, Mr. Chairman.

Dr. Graham, you mentioned in a number of places in your testimony about the need to bring the commercial sector into some of these access questions.

Is NASA willing to make the policy changes that would be necessary in order to assure some commercial viability in, for example, the ELV market?

Dr. **Graham**. Mr. Walker, our basic policy is, of course, the President's space policy. That's a very strong and clear policy which says that we should support the commercial use of space in a number of areas and we certainly strongly support that policy.

In particular in the commercial ELV area, we are now in a different environment than we were in prior to the *Challenger* accident. We are in a launch-poor environment today, in which, with all of the national capability that we can bring to bear in the next 2 to 3 years, we are still going to have a shortfall in the ability to carry payloads to low earth orbit.

We would very much like to see part of this backlog diminished by a commercial launch capability, a commercial vehicle capability which would complement the other commercial activities in space now underway, which are now, of course, the commercial communication satellites business, the upper stage, the low earth to geosynchronous orbit to transport which is being done very substantially by commercial endeavors today, the materials processing, which is just beginning, and the commercial platforms work, which is also underway.

We think that commercial expendable launch vehicle capability would be a good adjunct and a good complement to the other commercial activities that are being pursued. At the same time we believe that there will be a transition period necessary to establish a strong, healthy, viable internationally competitive commercial ELV capability and we think it behooves not only NASA, but also the other agencies of the Government to work together to help establish that transition period and to get through it as quickly as possible to see that a commercial industry comes into place which, in fact, can be incentivized by the Government, but is not subsidized by the Government, and which can make it on the basis of U.S. technical capability.

I would even be willing to look at the prospect of putting governmental payloads on such a commercial capability if it was budgetarily and financially responsible, reasonable, and if I believed I could come to you and to other Members of the Congress and to the administration and justify such actions on a financial basis.

Mr. **Walker**. Well, I think that's a useful step.

Let me ask you, then, about the purchase of a new orbiter. Would NASA be willing to consider having the private sector buy the additional orbiter if, in fact, a plan came forward that appeared capable of doing that?

Dr. **Graham**. Mr. Walker, NASA is, in fact, actively seeking proposals to provide either a commercial support or a partial commercial participation in a replacement orbiter and perhaps orbiters beyond a replacement orbiter in the shuttle fleet.

We are seeking people who are interested in that. We are working with them. We are listening to them very carefully and we are providing them whatever support we can, and we will certainly continue to do that.

We would be very pleased if an arrangement, a responsible financially sound arrangement could be made which would provide for a major part of the cost of future shuttles from the private sector. At the same time, we think it is very likely to be important not to delay the initiation of a replacement capability for the orbiter that was lost for any reason whatsoever. And, therefore, we would like to proceed with the replacement capability, under the conditions that as private support and private capability is developed that we work closely with that and attempt to integrate it into the program as thoroughly as possible.

I'll point out that we now have approximately $450 million of structural spares, that is major structural components for an orbiter which have already been funded and which are largely completed and which the last few of are in construction now. That would certainly be a contribution that could be put to any arrangement to provide for commercial support. The Government obviously has paid for that and has invested interest in those components, but we are dedicated to working with industry in any way possible to get on with the Space Program.

Mr. **Walker**. I thank you and I think that's a very useful answer.

Let me follow up with your answer previously on the ELV's that you would be willing to consider Government payloads flying aboard those if, in fact, you could justify it.

Secretary Aldridge, would the Defense Department consider utilizing the commercial ELV market as a way of getting some of the launch capacity that it may need over the next several years?

Mr. **Aldridge**. It's hard to define what you mean by commercial because we basically buy our boosters' ELV's commercially and the launch teams that launch are more primarily contractors who build the vehicles; so, it's a commercial venture in the beginning. The only difference is that there is an Air Force launch director who has ultimate say-so over whether to launch or not and provides the necessary security of the payloads that go on top of these orbiters.

It basically is a commercial venture as it stands. Some modification of that we could probably accept so long as we could maintain the security aspects of the program and ensure that that's well protected.

Mr. **Walker**. That's certainly understandable and I think that's a useful answer. I think the only difference we're probably talking about here is that a more, it would end up being a more integrated company that is looking at it in an entire range of services and that you therefore buy the launch off a company that has that integrated service.

Mr. **Aldridge**. The difference is that right now the Government takes some degree of the risk of the launch. Commercial venture would be that risk would be borne by the contractor himself and that they would have to have some high degree of responsibility if the launch failed. You know, who's liable in that. But, I think some type of arrangement could be worked out so long as our interests are protected.

Mr. **Walker**. Thank you, Mr. Chairman.

Mr. **Nelson**. Before I turn to Mr. Andrews, let me just follow up Mr. Walker's statement there about the possibility of private funding.

Dr. Graham, in the past, has NASA had any good reason to believe in its dealing of receiving various communications and/or offers? Has it had in the past any good reason to think that you will have a proposal that could, in fact, be worked out?

Dr. **Graham**. NASA has not found the case sufficiently strong in the past to proceed in that direction, Mr. Chairman, but at the same time it's important to realize we are in a very different launch environment today than we were prior to the *Challenger* accident. In fact, we are in a launch capability poor situation today as a country and will remain in that for at least the next 5 years virtually no matter what we do as we try to reduce the backlog of launches that are caused by the present hiatus in flight operations.

So, while the promise that we found in the past has not been sufficient in the view of NASA to proceed in the direction of private, heavy private participation other than as a supplier to the Government of space shuttle systems, we are certainly looking to that possibility in the future and we are exploring it as aggressively as we can.

Mr. **Nelson**. In what way, in the past, was it insufficient?

Dr. **Graham**. Mr. Chairman, I believe that among other things, the financial arrangements and the division of risk versus reward didn't appear sufficient to justify a really private endeavor, and by private here I mean just what Under Secretary Aldridge described where the private industry bears not only the prospect of substantial reward, but also the liable of potential risk in their operation and we would look to those issues very strongly as we proceed into further discussions.

Mr. **Nelson**. Was, in the past, the private financier asking for financial guarantees of the Government that were unacceptable to the Government?

Dr. **Graham**. Let me defer to Mr. Lee on that in that he's had a long history of experience in just these activities.

Mr. **Nelson**. The question is, In the past negotiations was the private financier asking for financial guarantees by the U.S. Government that the Government found unacceptable?

Mr. **Lee**. Mr. Chairman, to the best of my recollection, the financial conditions were such that the profit versus the tax breaks were a very serious consideration and I think Mr. Gillam who dealt personally with those could probably answer that question better.

Mr. **Nelson**. All right.

Mr. Gillam.

Dr. **Graham**. I have just talked to Mr. Gillam, Mr. Chairman, and you are exactly to the point that in fact the risk reward division was of principal impediment to those because it appeared to NASA that the risk was being borne largely by the Government rather than by the industry and that will certainly be a concern as we proceed.

Mr. NELSON. Mr. Gillam, do you have anything to add to that? You are saying that the risk versus the reward in your past negotiations was not acceptable?

Mr. GILLAM. Yes, sir.

Mr. NELSON. Is the slate clean, Dr. Graham, as far as the new negotiations? Has a new package come forth?

Dr. GRAHAM. Mr. Chairman, we have received indications and discussions of positions, some of them several pages long and very, very helpful in outlining general approaches; but, as you can well imagine, any such arrangement would be subject to very detailed discussions and very detailed scrutiny and there has not yet been sufficient time nor have we received sufficient information yet. I believe it would not be reasonable to expect people making proposals in this area to have had sufficient time to develop detailed proposals, and so I consider that still an open question.

Mr. NELSON. Is there a proposal before NASA at this point?

Dr. GRAHAM. There are suggestions and interest, indications of interest of outlines of general positions, but there is no specific proposal before NASA at this time that I am aware of.

Mr. NELSON. OK.

Mr. Andrews.

Mr. ANDREWS. Thank you, Mr. Chairman.

I'd like to ask you to address the issue of the space station and the effect the tragedy will have on the timetable of that project. As we know, the *Columbia* is less capable than any other orbiters and will certainly have a reduced payload at the altitudes that are necessary for the station.

Assuming that one of the orbiters ends up at Vandenberg, I'm assuming that's the case, that leaves us one orbiter to work with the station. Can we do that? Can we meet the timetables that we have set for ourselves to develop the station with only one orbiter?

Dr. GRAHAM. Mr. Andrews, if we are able to replace the capability that we lost in the *Challenger* accident within approximately 3½ years, which looks to us like the minimum time that it would take to first build a replacement orbiter, as one example, and then to fully check it out and establish it as operational, those being a 3-year and then about a 6-month process in turn. We believe that we can support the present space station plan, which calls for a permanent man present in space by the end of 1994 as mandated specifically by the President in his space policy.

However, I would also like to make it clear that that is a space capability and a space manifest which again is very subject to disruption from a delay or even a minor accident and, therefore, is what I described earlier as a space program and space manifest which doesn't have the resiliency that many of us would like to see. Nevertheless, the answer to your question is, yes, we can support the Space Station Program if we are able to recover from this loss in a short—comparatively short period of time.

Mr. ANDREWS. By short period of time, you mean the optimum. You mean that we start construction on another orbiter this afternoon and finish that orbiter in 36 months?

Dr. GRAHAM. If it were up to——

Mr. ANDREWS. You're giving us your best case estimate.

Dr. **Graham**. That is exactly right, Mr. Andrews. In fact, if it were up to me, I would start this morning. In fact, we do have the structural spares programs entrained, we do have work going on for parts for a replacement orbiter, and a very susbstantial inventory of those parts. So in a sense the spinup has already been established by the President and by the Congress in the Structural Spares Program, and that process will remove approximately 2 years leadtime from 5 years to 3 years should we be given permission to go ahead with the replacement orbiter. That's the assumption I'm making in the statement. I'm looking at it as a moveout program.

Mr. **Andrews**. Can we build the station using ELV's?

Dr. **Graham**. That capability is not within any existing plan that we would have and would be a very major change in both the station design and in the overall structure of our National Space Program.

Certainly, with only ELV's, the space station is just not feasible because within our present plan we don't have ELV's that are man rated to get people to the station or to bring them back to assemble the station when it gets into orbit to provide maintenance and logistics to it.

On the other hand, ELV's could provide a hauling capability to a space station that could be quite supportive of such an operation. So, I don't see it as an either/or issue. I hope we will be able to——

Mr. **Andrews**. Let's talk about the hauling system that's necessary in a second; but, we understand that the assembly of the station could take anywhere from 12 to 18 shuttle flights. Does that sound appropriate to you?

Dr. **Graham**. That's about the right range. The final configuration has not been specified yet, but that's a good working range.

Mr. **Andrews**. All right. If there's any slippage in your optimum time on building another orbiter, assuming that we do, can we continue with the program that we set for ourselves in building the station, meeting the time limits and do the other things that NASA wants to accomplish.

Dr. **Graham**. No, sir. In fact doing the other things that we want to accomplish and the Government wants to accomplish, the DOD is already being impeded by the loss. We will have a backlog of approximately 24 equivalent shuttle flights to orbit by 1990 and when we are at that point, we will be trying to work into that backlog to reduce it. We will obviously work with the manifest and work with the ELV industry, but there will be a substantial backlog through that period and that is of concern to us.

Mr. **Aldridge**. Just a point on that, if you didn't have the replacement orbiter, the backlog increases at a rate of 6 per year, all the additional orbiter does for you is to remove the backlog increase where you still have 24 missions to fly if they are real missions, and we think they are, because they are funded over the next 2 or 3 years.

Mr. **Andrews**. Once we build the station, how many flights per year are going to be needed to maintain them?

Dr. **Graham**. Mr. Chairman, that would take on the order of 8 to 11 flights per year for logistics, for supporting the scientific and the commercial research activities on the station and for, in the process of doing that, cycling the crew and maintaining the station.

Mr. **Andrews**. Just to handle the fuel requirements for the station, could you give us some estimate of how many flights are going to be necessary just to get the needed fuel up there?

Dr. **Graham**. I don't believe that's been fully established yet, because that's part of the baseline design activities that we are in; but, I will get you a response to that to give you a range to it.

[The material follows:]

The presently baselined propulsion system for the manned core of the Space Station consists of four propulsion modules, each requiring 1,500 lbs. of hydrazine (N_2H_4). These modules are required to provide for reboost to maintain altitude and emergency assist for the altitude control system. The amount of fuel needed is dependent on the operational altitude, the size of the power system (which determines the system drag to a large degree), and the solar activity cycle which governs the density of the atmosphere and thus influences the amount of fuel required.

For example, based upon a Space Station having a hybrid power supply of 75 kW and an operational altitude of 250 nautical miles, we expect to resupply the hydrazine propellant four times a year during the early part of the 1990's when atmospheric density will be high. As atmospheric density declines during the late 1990's, the requirements for resupply will drop to about one per year. These will not be dedicated flights, as the fuel resupply payload will be composed of about 6,000 lbs., plus 1,200 lbs. for tankage. Thus, one to four times per year, a total of about 7,200 lbs. of an Orbiter payload will be required to resupply fuel to the Station.

The number of platforms and free flyers to be similarly resupplied, and the amount of propellant required has not yet been fully determined.

Mr. **Andrews**. And the same question goes as to how many payloads are we going to need to bring back down again, which is also a question that I think needs to be explored and, really, not to take up a lot of time on the station itself this morning because there are a lot of members here I know want to ask questions, but I would appreciate it if NASA would present to our committee some form of written analysis of where you think the space station is vis-a-vis three orbiters.

Dr. **Graham**. Yes, sir. We will——

[The material follows:]

If the Challenger was not replaced, it would be possible to assemble and sustain the Space Station with a three-Orbiter fleet. However, meeting other scientific payload and commercial commitments, in addition to the DOD requirements, would be extremely difficult.

There will be ample capacity for returning Space Station materials to Earth, using the return of the currently planned 8-11 flights per year to the Station. The flights up to the Station will support Station logistics, scientific experiments, technology development, and commercial research and manufacturing. The return payloads will include processed materials, completed experiments, and waste disposal as well as personnel rotation.

Mr. **Andrews**. And give us some prognosis if, in fact, we have a fourth capability in 36 months, which is your optimum timeframe.

[The material follows:]

Rockwell International Corporation has stated an additional Orbiter could be built in 36 to 42 months.

Dr. **Graham**. We will do that. To predict the result, I suspect that it will appear that as we proceed with the space station and the other commitments we have, such as those to the DOD, which are very high priority commitments, that three-orbiter fleet without some very substantial augmentation of some other type, would exclude a majority of the scientific and commercial activities that we would like to conduct with the space shuttle, which in many cases require the operation of scientists, engineers, and astronauts to carry out.

Mr. **Andrews**. And, Mr. Chairman, with your permission, I would like this report, when it is completed, to be included in the record for hearing purposes today.

I have one more short question. Because of the delay in time, because of the critical national security needs that the Secretary has alluded to, because of the critical scientific payload needs, Dr. Graham, that you have mentioned, because of the potential problems that an error or a malfunction may occur on another orbiter, as the chairman has mentioned in his questioning—where we could lose another orbiter for a period of time and causing delays in the shuttle program, because every inch of space on every mission is precious and because of the risks involved, Dr. Graham, is it appropriate that we fly a journalist in space?

Dr. **Graham**. One of the goals of the U.S. space program is not just to stay where we are, but to expand our, not just our skilled test pilots, such as Admiral Truly, and not even our difficult scientific missions, but to take our culture into space and to bring a certain part of our space experience back to the people who pay for it who are the citizens of the United States, who are very strong supporters of the space program. And we believe that providing a journalist in space will be able to bring that experience to the people in a way that those of us who are engineers, scientists, and test pilots for all of our enthusiasm, may not be able to do adequately.

At the same time, when we put a journalist in space, we'll make sure that he carries out other activities and other missions as well so that he does a full share of his work when he is there, and I believe that it is a sound program.

Mr. **Andrews**. I must say, Dr. Graham, that your statement troubles me for the very reasons of the premise that I made in my question. It really troubles me and I really question the appropriateness because of all your previous testimony this morning and the comments that both of you have made that we should not, NASA should not thoroughly reexamine the idea and the concept that it's necessary and appropriate at this time to put a journalist in space, a poet, a painter, a disabled American, a writer, public officials. I think we're at a stage right now where we really owe ourselves the responsibility to reassess what we can do on the missions that must be done, these payloads that we must have and we've got to do. And if you list your priorities, I find your comments laudable, I share that view, but we have a different circumstance today.

Dr. **Graham**. You say at this time. Of course, we have a very serious issue of priorities and we are working that as a priority issue. We will continue to do it and we hope to give the journalist in the Space Program appropriate priority, but we are not committed to any specific launch at this point of a journalist in space, and we hope to work that into our schedule, into our capabilities in a way which will be supportive and not disruptive of the other issues and we'll certainly take into account the priorities of our launch capability.

Mr. **Andrews**. And does that include the other disciplines that I mentioned?

Dr. **Graham**. Yes, sir; it includes everything we'll be doing with our orbiter fleet and, in fact, with our entire space launch capability.

Mr. **Andrews**. Thank you, Dr. Graham.

Mr. **Nelson**. Thank you, Mr. Andrews.

You brought out an important point, before I recognize the chairman of the Science and Technology Committee, in your questioning some new information and that was that just to build the space station is going to require equivalent flights of 12 to 18, I think, was the statement here, is that correct?

Dr. **Graham**. Yes, sir. We hope it's closer to 12 than 18.

Mr. **Nelson**. Whereas, last summer's hearing on assured access to space as we were trying to figure out how much launch capacity we need into the 1990's, we were looking at the figure given to us of seven to eight equivalent cargo bays.

Dr. **Graham**. That may have been per year, Mr. Chairman.

Mr. **Nelson**. I think it was. You're saying total?

Dr. **Graham**. Yes, sir; for the construction of the first phase of the initial capability of the space station.

Mr. **Nelson**. Then there is not that much variance.

Dr. **Graham**. That would be spread over 18 months and I think this is reasonably consistent with the figures that you were given.

Mr. **Nelson**. Originally the figure given to us. I distinctly remember this was that it was somewhere in the range of six to seven equivalent shuttle flights to construct the space station, that was the initial figure that was given to us.

Dr. **Graham**. I will go back and look at that figure, Mr. Chairman, but you must remember that the space station itself is in what we call phase B design. It is still in the conceptual design phase and it has changed in configuration substantially since last year, and, therefore, we'll have to ask you to be slightly patient with the design configuration until we get a little further along the process.

Mr. **Nelson**. I'm not suggesting in the least impatience, I'm just suggesting curiosity as the story continues to be told as we redesign, et cetera, as we figure out what we have to have and, therefore, what we have to have in the way of launch capacity and then, you know, part of the discussions that we had last summer, we had to close the doors because we had to go onto the secret clearance level in talking about things that the Defense Department might need as we look into the 1990's. So it's a complex equation and you all are helping us very much. We appreciate that.

Mr. Chairman, you honor us by your presence. Mr. Fuqua.

Mr. **Fuqua**. Well, thank you. I won't take long and I want to welcome Dr. Graham and Secretary Aldridge and, Admiral Truly, I am glad to have you sitting over there and not after a flight. We are delighted to have you and also Chet Lee.

Dr. Graham, in response to the question that Mr. Andrews made, the use of the ELV's in supporting the space station, those are not man rated so no personnel could ever go on board those?

Dr. **Graham**. That's right, Mr. Chairman.

Mr. **Fuqua**. So that would limit considerably the availability of those who support space station activities?

Dr. **Graham**. Yes, sir. They would—if we were able to do that, and if that proved to be the most effective way to support the station, it would be on a—basically a cargo-hauling basis and while that's not in the specific plan at the moment that we have had, nonetheless the capability is within the overall designs of the space station. We are trying to look across the whole issue again.

Mr. **Fuqua**. Could you explain how that would work? If you had men on board the space station you delivered cargo to one of the units on a ELV, how would they get to the unit, remove it, and get it to the space station. It would seem like it would be rather nifty.

Dr. **Graham**. I believe the general concept is fairly straightforward, but you raise a very important question and that is once you begin to have the crew of the space station interact directly with the unmanned systems, the safety issue is a very central concern and the unmanned system would have to be designed with the crew handling and crew interaction and the crew proximity as a very specific constraint on it from the ground up. Perhaps Admiral Truly would like to add something to that.

Mr. **Fuqua**. And I don't know if you have it. If you do, what type of additional cost are we talking about for the ELV?

Admiral **Truly**. Mr. Chairman, I think the question about appropriate use of the ELV in conjunction with the shuttle is an interesting one that should be looked at for station construction, but it should only be done, I think, if it was clearly financially advantageous to do and it would require that the development, which is not planned now I would think, of a rendezvous docking capability unmanned which today we don't have, it is more complicated, I think, than strictly a cargo-lifting capability; but, it's an interesting——

Mr. **Fuqua**. That covers the point I was wishing to make.

Admiral **Truly** [continuing]. It is an interesting concept for the 1990's or beyond when we do have heavy life ELV capability in conjunction with the shuttle.

Mr. **Fuqua**. Well, you certainly off the bat, I think, have to have an OMV, orbiting man vehicle, or maneuvering vehicle, to attach to payloads to move them around.

Dr. **Graham**. Yes, sir. That would be a very——

Mr. **Fuqua**. Plus a rendezvous would be a rather exciting proposition, too, to begin with.

Dr. **Graham**. At first an unmanned OMV would be a very, very useful adjunct to any such unmanned logistic support and we do hope to proceed with that program in the immediate future.

Mr. **Fuqua**. Yes, well, that's requested in the budget this year.

Dr. **Graham**. Yes, sir.

Mr. **Fuqua**. And I hope that it's approved, because it is a very important adjunct with the shuttle. It would be more important, I think, without the shuttle, if that procedure could be developed.

Dr. **Graham**. Yes, sir.

Admiral **Truly**. Mr. Chairman, if I might add to that on the rendezvous thing; as you know, the Soviet program has developed and demonstrated unmanned rendezvous and docking and so it is certainly technically feasible, but it is the funding to develop it and man rate it in our system, I would think, that would require very careful scrutiny.

Mr. **Fuqua**. So far as I understand, there hasn't been any efforts put forth to develop that technique, thus far.

Dr. **Graham**. There are very preliminary basic laboratory research activities underway in some of our centers that will help us with both manned and unmanned docking capabilities eventually, but they are what I would describe as just beyond the gleam in the engineers' eyes today, and certainly no program in that direction is entrain at this point.

Mr. **Fuqua**. Thank you, Mr. Chairman.

Mr. **Nelson**. Thank you, Chairman Fuqua. You've brought out a very important point that as we deliberate on this question of launch capacity and we talk about putting up cargoes with unmanned ELV's that they, in fact, have to have man rating and what is, therefore, the additional cost to do that if you are docking with a manned system. Thank you for bringing that out.

Mr. Lujan.

Mr. **Lujan**. Thank you, Mr. Chairman.

The thought strikes me, why couldn't we borrow the Russian vehicle to do it with. We want international partners, that might be one way to do it. I mean that facetiously, however.

There's many compelling reasons why we should build that fourth orbiter, but let's see how we are going to pay for it. That's the—one of the first things we have to look at.

Will the DOD share in that cost? Are there any plans to do so

Mr. **Aldridge**. I think the issue's bigger than that. I would say that the——

Mr. **Lujan**. Bigger than paying for it?

Mr. **Aldridge**. Bigger than the Department of Defense or NASA's budget. This is essentially a national emergency and the taxpayer has to pay for it and I don't think you—we want to worry about in whose budget it belongs. It belongs in NASA's budget. It should be paid for by the taxpayer. I think those in DOD would not say, well, we ought to cancel or cut out F-15's, or F-16's, to pay for this particular effort. It should be borne by the taxpayer in the appropriate manner.

Mr. **Lujan**. Well, that's very nice to say, but, you know, my—my followups were going to be what are the NASA things that we're going to have to—to give up. How much is the investigation going to cost?

Dr. **Graham**. We don't know yet——

Mr. **Lujan**. Just a——

Dr. **Graham** [continuing]. Mr. Lujan, we expect that the investigation plus the modifications to our present flight equipment will run approximately in the $100 to $200 million or possibly $300 million range, but that's a guess and if you ask me to defend it, I would say that that's the best estimate we've come up with so far. But since we don't have yet the definitive cause of the accident, nor have we actually recovered specific pieces of hardware from the ocean floor that we will need in the investigation and given the high price of those recovery operations, I can only say it's a rough estimate.

Mr. LUJAN. Well, you know, looking at different things in what priorities we have to set, we will not launch 10 of those missions this year. If you're talking about until September and you have, you know, 1 in March, that was the schedule the *Challenger* accident, 2 in May, 1 in June, 2 in July, 1 in August, 2, 3 in September, that's a total of 10. There's certainly add-on costs. I don't mean your marching army now, but buying the SRB's, buying the external tank, doing all of the things that you have to do. My impression has always been that there's somewhere around a $42 million add-on cost every time, every time you launch. Therefore, if you're not going to launch 10 times, you're not going to have 10 of those add-on costs which would mean $420 million, which is a substantial amount of money. Subtract that from that, the cost of the investigation, and you have one or $200 million left. You then look, you know, we can't do everything in the world. It's one thing to say, well, the taxpayers are going to have to pay for it, but the taxpayers are telling us, balance that budget, and within that if you're going to do that, you have to see where you're going to get the money.

So, assuming we come up with $200 million from savings on those 10 launches and perhaps even more than that if we don't launch for a year. There's $200 million of it.

That is $200 million that we have in the 1987 budget.

The space station, which I dearly love and don't want to see anything happen, but that's $400 million in 1987. If you took those figures, delayed that a whole year, took that funding, that would give you $800 million. We're one-third of the way there.

Does that seem like what will be the result of this whole business of building an additional—that means, we don't want to give up any F-16's or F-18's or any carriers or anything like that. Is that within your planning or have you looked at the alternative financing?

Dr. GRAHAM. Mr. Chairman and Mr. Lujan, of course the *Challenger* accident was entirely unanticipated. It was not considered in the 1987 or outyear budget and was an asset loss altogether of approximately $3.2 billion or approximately roughly half of the NASA annual budget.

I know of no way to recover that amount over the next 3 to 4 years by offsetting it within the existing NASA budget without creating an entire change in the U.S. National Space Program and space policy.

On some of the detailed elements, the situation wasn't quite as bad as I think you may have indicated. For example, TAV in 1987 is $45 million——

Mr. LUJAN. That's NASA——

Dr. GRAHAM [continuing]. $200 million is the——

Mr. LUJAN [continuing]. DOD has, what, $150 million or——

Dr. GRAHAM. That's correct.

Mr. LUJAN. OK.

Dr. GRAHAM. Understand.

The—nevertheless, you're exactly right in that there is a very major budgetary issue there and its impact will be significant however we go about dealing with it.

Perhaps Mr. Lee would have some further comments on the specifics.

Mr. **Lee**. I would only qualify your remarks, sir, in one sense. You estimated $40 to $50 million savings, and I believe I'm correct in saying that that is only effective if the decision is made to cut down the production of those consumables 18 months to 2 years in advance.

When the production is going, those savings will not be effective. Now further down in several years, the agency could reduce production—effectively you might get a lot of that money back, but in the near term of this year, that won't be that effective.

Mr. **Lujan**. That just adds to the difficulty that we—that we face in trying to work toward the balanced budget and funding a—a big loss like this. Certainly—you know, I think we have public support for a fourth shuttle, but you have to look at where you're going to get the money to do it.

Let me ask you, before the *Challenger* tragedy, what kind of a backlog did you have?

Dr. **Graham**. The manifest backlog? Let me ask Mr. Lee again to address that since he works our manifest issues specifically.

Mr. **Lee**. Well, Mr. Lujan, building up our flight rate to 1989 and 1990, as the chairman will remember, we discussed this in the summer hearings, we were building up with a flight rate that went to 17 to 21, I think, and then to 24—I am not sure of those numbers—and in the 1989-90 timeframe, the DOD requirements were not as high as they become later. The space station had not come on line and we had a number of opportunities that were available to provide for commercial and foreign. I think that was an issue that Mr. Chairman had raised about the five equivalent flights that we had considered at that time.

Beyond that, the requirements went up. The space station requirements, which have been discussed earlier, increased to the seven to nine flights a year. The DOD requirements were higher, and that's, I believe, why Mr. Chairman had the separate meeting.

So that's essentially our requirements at that time. Only until the 1993 and 1994 time did the requirements go above what appeared to be the 24 capability——

Mr. **Lujan**. What I meant was, at the time—you know, what you put on *Challenger* on that day, did you have some that you hadn't been able to put into launches that you would have liked to before and you just weren't able to do——

Mr. **Lee**. Yes, but most of those, sir, were not the major payloads, but were in the fields of secondary payloads as we call them, materials processing the smaller ones.

Our student experiments, that's where the big backlog was. We had quite a bit of backlog in those, but in the major payloads, they're very few, very few. There were no DOD payloads backlog.

Mr. **Lujan**. None.

Mr. **Lee**. They were scheduled to fly when they would become available.

Mr. **Lujan**. We—the testimony shows 24 launches. Was that a figure that you were using, Mr. Secretary, for 1986?

Mr. **Aldridge**. No, sir; that was the steady state condition we were—you're talking about the 24 flights per year on the shuttle?

Mr. **Lujan**. Including 1986?

Mr. **Aldridge**. That did not include 1986. That was, I believe, starting in about 1989 that the anticipated shuttle flight rate that we in DOD were planning, and I think that NASA was planning, was 24 flights a year off the shuttle.

Mr. **Lujan**. And before that, we were—before those dates, we were planning something like 16 or something——

Mr. **Aldridge**. We were building up to that 24, right.

Mr. **Lujan**. Right.

Dr. **Graham**. It was 14 in 1986, Mr. Lujan.

Mr. **Lujan**. Yeah, OK.

How many of the launches have slipped? Most of them?

Dr. **Graham**. I don't have the precise statistics, although I can get them, but because of weather and mechanical issues, a substantial part slipped anywhere from a day or two to a few weeks, and of course, 51-L had slipped from the *Challenger*, which had the accident, it slipped from the previous year, but that was a slip caused by the TDRSS satellite readiness, and not a shuttle system issue as such.

Mr. **Lujan**. We also have to rebuild that TDRSS, don't we? That is——

Dr. **Graham**. Mr. Lujan, we have in production, in the pipeline, another three TDRSS satellites and we believe that as soon as we return to space flight, we can put one of those in orbit and then follow it up with the second one, which would give us most of the capability we need.

Mr. **Lujan**. They're ready, are you saying? The second and—or what would have been the third and fourth?

Dr. **Graham**. They're—the first one—the first one to be launched from this point forward is ready. The one behind that and the one behind that are nearing completion and would be ready by the time we would be able to launch them.

So the gap in capability would occur not in the immediate future, but when the existing TDRSS production finally becomes inoperative on orbit, and then we would have to replace that and that would occur sooner than if we had put the TDRSS that was in the *Challenger* on orbit, so it's not an immediate issue, but it is an issue which we have to look into in the midterm and I suspect today. If you want an estimate of how we might accommodate that, it would be more useful to look to replacing that lost TDRSS at the end of the existing TDRSS pipeline, possibly with a later generation capability, rather than trying to go back and reconstruct one more satellite of what is by now becoming at least less than state-of-the-art technology.

Mr. **Lujan**. The next one is, of course, configured so it only goes on the shuttle.

Dr. **Graham**. Yes, sir; the next——

Mr. **Lujan**. TDRSS No. 3 is what it would normally be, I guess.

Dr. **Graham**. Yes, sir; the next three are in that configuration at the moment.

Mr. **Lujan**. Three, four, and five? If I'm referring to them, the one that's up there, the one that blew up——

Dr. **Graham**. Yes.

Mr. **Lujan** [continuing]. And then this third—three would be the next one——

Dr. **Graham**. Right.

Mr. **Lujan** [continuing]. So three, four, and five are already configured so that they only—they're not ELV-compatible?

Dr. **Graham**. Well, they weren't specifically designed for ELV use. We're going back and looking at the issue of whether there's any prospect of converting them to ELV's, but I think that would prove to be a very difficult thing to do because of both their design and their total weight.

Mr. **Lujan**. Thank you.

Mr. **Nelson**. Thank you, Mr. Lujan, and Mr. Lujan, your line of questioning has brought out important testimony that we had last summer, and just for the record, I'll refresh everybody's memory.

We were talking about during the first half of the 1990's that we say equivalent launches of between 26 and 32 space shuttle launches and included within the high figure there of 32 was space-station-related launches of 9 to 10, other civil launches, 6 to 7—this is per year—strategic defense initiative-related launches, 5, and all other DOD launches, 11.

So, as we evaluate here, having assured assess to space, that was the testimony then and then let's track it and see how it might have changed what we have to do, et cetera.

Now, before I recognize Mr. Torricelli for his questioning, let me point out that he has filed a bill shortly after the tragic accident for a replacement orbiter, and as we discuss this, Mr. Torricelli, we might want to talk about also the fact that we have to look at this accident hopefully as a one-time event that's never going to occur again and that that thrusts the Government into the position of being a self-insurer.

We can't go and insure all these orbiters and now we've had this tragic loss and we've got to pay the bill. So, as we look to the future, what are we going to do in light of that and when we look at your bill for a replacement orbiter, how do we look at it? Do we look at it that we have to pay the bill within the existing NASA budget, or would you do it as you would normally do it, pay it from outside because you were insured in this case, the Government being the self-insurer?

Mr. Torricelli.

Mr. **Torricelli**. Thank you, Mr. Chairman, and I think it is worth noting that not only, one, you should be commended for having these hearings today, but that legislation such as my own to, in a relatively brief time, replace the shuttle *Challenger* would not have been possible but for the hearings you held last summer and the leadership that you showed ensuring that replacements parts were available so that in an emergency, we would be able to continue the program.

This has been an interesting exchange this morning. An exchange of ideas and intellectually, I assume, is of considerable value to all of us.

The fact remains, however, that our country has made a variety of commitments from the strategic defense initiative to military surveillance to arms control necessities to the space station, to scientific and commercial ventures. Those commitments being made cannot be considered separate from our shuttle capacity because, from what I'm hearing this morning in the final analysis, after we've had all the interesting conversations, our country has no choice. We cannot consider the decision whether to replace the shuttle *Challenger* separate from our commitment from all those other endeavors.

If we're going to not go forward with the Shuttle Program in earnest to its full capacity, we have to admit to ourselves that we cannot keep our other military, commercial, and scientific commitments as well.

That is the reason, Dr. Graham, why I have filed legislation to authorize and to appropriate $400 million to, in this year, begin the construction of a new shuttle.

I would like your response to whether you consider that in this year to be an appropriate sum, the $400 million sum if we were to begin immediately with new construction.

Dr. **Graham**. As I understand the question, it is that if we were going to go for a replacement orbiter, what would be the appropriate budget authority for 1986? That's an issue which is very much under review within the Government, but I think the figure that you quote is certainly appropriate, and in fact, if we were going to look to replace some of the other vital capability that was on the orbiter that was lost, it might be slightly higher than that.

Mr. **Torricelli**. You believe it would be slightly higher than $400 million.

Dr. **Graham**. Depending on what you're talking about. But if you're talking about including the inertial upper-stage airborne support equipment, the cradle the TDRSS was sitting in, if you're going to include, of course, the engines, which is an essential part of the orbiter, and the other items that were lost, the remote manipulating arm and so on, it might be slightly higher than that, but that's the right ballpark, yes, sir.

Mr. **Torricelli**. Mr. Aldridge's position, I thought, was quite clear on this. I will restate it, but correct me if I am wrong, that it is your belief—you seem to share my belief that in essence, we have no choice and that we should, in fact, go ahead to replace the shuttle.

You, Dr. Graham, used the term that it was an emergency situation. This is an emergency supplemental. Therefore, I was confused by the word "if." In your judgment, is this an "if" situation or do you share Mr. Aldridge's comments and the sentiments expressed in my legislation that we must, in fact, go forward with replacement this year?

Dr. **Graham**. I certainly support the statement that Secretary Aldridge made and, as I indicated in my first responses that there—in all the analysis we've done, there appears to be a very strong argument for proceeding with the replacement orbiter.

At the same time, I don't want to mislead you into appearing to state that the intergovernmental process which is required to make such a major decision as this has been completed. That process is running at the direction of the President; it is running at a very high speed; it is running very well. But it has not yet been able to have the time necessary to converge on a specific position that encompasses all the issues that must be dealt with.

However, I look to that process converging in the very near future.

Mr. **Torricelli**. But our sentiments are of similar nature.

Mr. **Aldridge**. I think that is correct; yes, sir.

Mr. **Torricelli**. The question Mr. Lujan rose about the savings involved in the NASA budget to this year or prospectively because of launches that are not taking place, if we are looking at an annual cost during the construction of a new shuttle at $400 or $500 million for 3 or 4 or 5 years, is it yet possible for you to say how much of this $400 million could be absorbed by current savings in NASA's budget because of the fact that these launches are not taking place?

Dr. **Graham**. For 1986, we have identified $167 million in savings in the NASA budget, given, of course, that we are already part way through the fiscal year. We have had successful launches before the *Challenger* in this fiscal year.

The cost of recovering from the accident unfortunately more than offset those savings, and we will be working in a very difficult position to recover from this accident within the existing——

Mr. **Torricelli**. I recognize that, Doctor. What I'm trying to look at is if we're talking about approximately a $400 figure, how much of that is going to be available from savings? For example, it was noted that the booster rockets and the motors and the solid fuel and other items that are not being used this year presumably will be able to reduce the moneys that you require when the launches resume later this year or next year.

Dr. **Graham**. Unfortunately, they won't reduce the moneys in this year's budget because there is a leadtime for those items and in the financial commitments for them. So we have identified $167 million in savings in fiscal 1986. We have identified 100 and—at least that much and potentially more in additional costs we've encountered in 1986 because of the accident, so at best, we're back to where we started with the budget of $7.334 billion as a result of the accident if we were to take no action whatsoever to regain the capability that was lost on the *Challenger* accident and, in fact, anything else we do in the budget toward the *Challenger* accident within the existing budgetary figures which were developed and approved before the accident would require a direct reduction of programs that were in the approved 1986 and beyond budget.

Mr. **Torricelli**. I thank you. Mostly, Dr. Graham, I thank you for stating so frankly that, in fact, we are facing to some degree a national emergency, that people not consider this an idle issue, that we have a series of national commitments that are in real jeopardy until we face this decision.

Mr. Aldridge, in your answer to Mr. Lujan's question concerning the availability of DOD funds, I think you accurately stated the bottom line, that it must come from whatever sources but it eventually falls upon the taxpayers.

However, I think the question—the answer he may have been seeking and the one that I would like to hear is is the DOD door open or are you taking the position, a firm position, that we should not be looking to the Pentagon to play a role in funding a possible replacement from—shifting of your programs as well as from Dr. Graham's program?

Mr. ALDRIDGE. Let's see, there are two aspects of that. One, let me address the problem, are there any savings that could be realized in the Department of Defense to offset that? There are no savings. If we have to just live with the existing situation, in fact, the costs will increase because some of the contractor costs that we were phasing down as a result of anticipated launches no longer can occur and the result of having to store the spacecraft in an environmentally secure area is going to have to increase and there will be costs just to do that.

I think the real question is we are looking at this issue in an interagency process. That interagency process includes not only the NASA and DOD, but also the Office of Management and Budget and a decision that will ultimately be made by the President.

If the President believed that he wanted to offset those costs that DOD and NASA will undoubtedly realize as a result of this tragedy, we could—we'll obviously go to DOD and try to find those funds.

Right now, we're not offering any funds to do this job and I——

Mr. TORRICELLI. I didn't expect——

Mr. ALDRIDGE [continuing]. And I—we hope that the taxpayer will realize——

Mr. TORRICELLI. I just—I mark down a "yes." [Laughter.]

Mr. ALDRIDGE. I'm afraid I'd mark down a different answer, sir.

Mr. TORRICELLI. Dr. Graham, I was involved over the period of almost a year in a series of exchanges with your predecessor, Mr. Beggs, on the question of competition with the Morton Thiokol Corp. on the solid fuel.

Some progress was initially made and a decision, of course, was made to proceed on some basis with competition for Morton Thiokol. I am, however, curious about part of that decision of—that 50 percent would go to competition, from my understanding.

Why is it if Mr. Beggs or if yourself accepted the suggestion of myself and others of the need to competitively bid the solid fuel that you would stop at 50 percent and why would it not include the entire items as involved with the solid booster?

Dr. GRAHAM. One of my first decisions as the Acting Administrator was to determine that NASA should proceed with an effort to develop a second source for the solid booster motors and I have provided that specific guidance to the agency and we are proceeding in that direction.

One of the major contributions of a two-source procurement for the solid motors is that in the competitive environment, we think it will get a better price for the Government from whichever supplier comes in at the lowest cost. And if we are able, in fact, to get to a condition where we have two suppliers, we would like to do all we can to maintain two suppliers, to maintain that competitive environment going out into the future.

Now, having said that, there are no funds in the budget for qualifying a second source, and as you know, qualification is extremely important at all space systems and particularly so in manned space systems.

So qualification costs would have to be recovered by a second source as a result of the efficiency of his operation and basically——

Mr. Torricelli. My concern, Dr. Graham, is——

Dr. Graham [continuing]. Out of his profit.

Mr. Torricelli. My concern is whether a 50-percent offer of a second sourcing is an offer at all.

Dr. Graham. Well, I——

Mr. Torricelli. If one company is assured 50 percent of the contract and then can spread its cost of production over that, does the second corporation really have an opportunity to compete?

Dr. Graham. There is no policy in place, nor is there any contemplated which would specify 50 percent or any other fixed percentage to any one supplier.

As I was saying, the attempt here is to maintain a long-term dual-source capability and a competitive environment and I believe that the proportion that either supplier receives in his contract should depend on his competitive capability on how good a price he can deliver for a reliable, safe, sound product to the Government.

Mr. Torricelli. Let me just see, then, if we have the same interpretation of this because I believe it is an important issue.

Your position is that the solid rocket fuel in its entirety should be available for competition between two corporations without reservations and that we should apply the same rules for the cost of recovery of any facilities that must be constructed for either corporation on the same basis?

Dr. Graham. To the greatest degree possible, given the past, yes, sir, we should try to establish this on a level playing field. And I would subscribe to your statement with one caveat, and that is we don't want to get back to a situation at some point where we have created a one-supplier situation so that we don't have the competitive environment as we go out into the outyears.

The division between two possible suppliers should be very sensitive to the competitiveness of each of those suppliers' capabilities.

Mr. Torricelli. I appreciate that, sir——

Mr. Mineta. Would the gentleman yield?

Mr. Torricelli. I'd be glad to yield.

Mr. Mineta. But given the fact that we have now a series of memos that date back to some of the flaws that we're now without presupposing the findings of the commission, is it reasonable to go ahead with more orders from the present supplier, given what we know now?

Dr. Graham. We have a process in place which is looking at that. We are not casting any additional motors at this point and we are not machining any additional case billets at this point and we will not until we understand what we need to do to make sure that we have a reliable motor and a reliable solid rocket booster.

We have seven sets of SRB's in the inventory at this point already to go and we think that will get us into a recovery period.

At the same time, over now two—just 2 weeks ago, I initiated a design modification effort to look at the existing SRB design, and particularly the field joint design, to look at the background on it and to produce design modifications which would further secure that particular joint and to try to do it in a way which makes as efficient use as possible of existing hardware and existing motors.

We think we have some promising approaches in that regard. We're pursuing them very vigorously and if they continue to prove to be effective, we will, in fact, make that change.

Mr. NELSON. Mr. Torricelli, you had one more question?

Mr. TORRICELLI. I did, and, Dr. Graham, just let me say, because I think the chairman has accurately stated we don't want to be in the business of presupposing any results of any investigations, let it merely stand that for purposes of how we approach the second sourcing with the solid rocket fuel and on all other items, the fact remains that quality is a result of competition.

And this struggle that we have had between—previously with your predecessor and members of this committee, to ensure full, fair, and open competition must go forward, and I hope that you will review the decisions made by NASA on the question of the second sourcing of the solid rocket fuel to ensure that the commitments that you've made here will, in fact, come to pass. Because, from my own reading, my judgment will be while others may enter, only one will emerge, that the competition is not as free and fair and open as it might appear.

Let me, Mr. Chairman, finally then state that I think it's important, Dr. Graham, for you to leave here with some reaction to the next large issue on the horizon with NASA and that is the President's Orient Express. When it was announced to the Congress in the State of the Union, it fell upon considerable silence. That silence has remained.

I do not want my strong commitment to the Shuttle Program, or my belief in NASA and its operations or the silence that has resulted from the President's proposal to in any way be interpreted as an acceptance of the Orient Express or these budget priorities.

An administration whose budget would end the effective operation of Amtrak, curtail commuter operations in my State, severely damage the transportation network in our country in the air and on the ground has no business proposing a 2-hour sushi trip across the world on the taxpayers, and that is a battle that will be fought in the future, but I think it is important for, in the interest of frankness, to leave here today understanding it is at best a controversial issue.

Thank you, Dr. Graham, and thank you, Mr. Chairman.

Mr. MINETA [presiding]. Mr. Barton.

Mr. BARTON. Thank you, Mr. Chairman.

I want to commend you, Dr. Graham, for the job you've done in trying circumstances. I want to let—assure you that this committee, with our subcommittee chairman, who's been in space and our committee chairman who's known as the father of the space shuttle, will work with you to try to keep NASA on its—its track.

I do want to start out, though, so far, there has been an assumption and may prove to be a fact that we are going to replace the—the shuttle orbiter.

I don't share that. I feel that we're in a situation where we need to rèevaluate our Space Program. We need to reevaluate whether we need to have four orbiters.

Congressman Andrews earlier asked the question about the journalist in space. I think journalists would have a good way to investigate this. I think we need to go back and determine what it is that we want out of our Space Program, how we want to get it, when we want it, and who we want to do it.

It's obvious that there was a need and a—a use for the fourth orbiter, but it's not here now, and so I want to focus back in on what I think is the original reason for these hearings and specifically, you know, that we have access to space, that it be assured access. I think we all agree that we need to do that.

But to get into more detail, whether to replace an orbiter that is basically sixties and seventies technology, just replace it as is, or perhaps redefine the mission of the remaining orbiter fleet.

Now, one of you gentleman was talking about payload capability. We've got two orbiters that have the capability of 65,000 pounds; we've got one orbiter that has a capability of 58,000 pounds. Of the missions that were on schedule or in the pipeline, how many of them, what percentage of them require either that large of a lift capability or a manned capability once the payload is in orbit?

Dr. GRAHAM. I would like to ask Mr. Lee to give you an approximate answer to that, and then if you will permit me, to take that as a question to give you a detailed answer in response, in written form.

Mr. BARTON. Sure.

Dr. GRAHAM. Chester.

[The material follows:]

Approximately 44 out of 141 payloads (31%), which were scheduled through FY 1989, would have required large lift capability (50% or more of a Shuttle flight). About 70 of 141 (50%) would have required extensive manned support.

Mr. LEE. Mr. Barton, as far as the NASA payloads through the civil community goes, very few of those, except for the planetaries, require the full capability, the full lift capability that you were discussing, a 65,000. Certainly the Galileo Planetary, perhaps some of the others in the future.

Most of the civil payloads are manifested in what we call a mixed cargo, and you adjust to the lift capability of the particular orbiter as to how much you carry. Now there are many DOD missions that in fact require the lift capability that we have discussed as being higher.

I think Under Secretary Aldridge has addressed the fact that the two orbiters, 103 and 104, are the ones he needs to carry out his very important missions; and we indeed have not manifested DOD payloads on the heavier vehicle, the *Columbia*, except perhaps on occasion the navigational communications satellites which are not major heavy payloads.

With regard to the requirement of man, except for the zero gravity, in effect you could probably do most of them on an expendable launch vehicle. For example, of the 32 commercial and foreign payloads that we have under contract today, probably 6 of those—the spacelab missions, the Eureka retrieval missions, and the SYNCOM communications satellite—six of those could probably—would have to stay on the shuttle. The rest of them could be flown by ELV's.

Mr. BARTON. So one can state that an alternative to replacing the fourth shuttle orbiter would be to utilize expendible launch vehicles to a greater degree; that there are many payloads that could be put into orbit in that fashion. Is that a fair statement?

Mr. LEE. I think that's what Dr. Graham said earlier, in a mixed fleet.

Dr. GRAHAM. It would be in some sense an alternative, but I think a more accurate view of it would be as a complement rather than as an alternative. Even if we develop a substantially greater ELV capability than we have online today, we will still have a backlog in lift requirements going well into the 1990's, and it appears to me that the real requirement, if we are to maintain the programs in the general form and substance that we have established under your support in the past would be a requirement for both capabilities to be enhanced, both shuttle and ELV capabilities to be enhanced.

Mr. BARTON. I understand that. I guess the point that I am trying to get across is that we should set priorities for the asset that we have, which is at current a three-shuttle fleet, a three-orbiter fleet. And we've got structural spares for what, maybe a fourth or a half of another orbiter, something in that range.

We also have made a commitment to a commercial, expendable launch vehicle activity. You indicated there is a backlog. In the private sector, I think this is an opportunity to commercialize that part of the backlog that can go up into space without the manned capability on our NASA orbital fleet. And I would hope that the subcommittee and the full committee reviews that.

I guess another question I have, if we decide to replace the orbiter, are there improvements that could be implemented into a fourth orbiter? I mean, would we get the same orbiter that we had, or would it be a new, improved version?

Dr. GRAHAM. There are no doubt some improvements that would be incorporated at the detailed engineering level. However, it is important to realize that the design, development, test, and qualification process that leads up to an operational man-rated space system is a very substantial and very expensive process. And to make major design changes would require us to reenter that process; and in my own view at this point I believe it would be better to look to a substantial follow-on capability beyond the effectiveness of the present shuttle fleet and the present shuttle infrastructure rather than trying to make modifications in train.

Perhaps Admiral Truly or Under Secretary Aldridge would have some further comments on that.

Mr. ALDRIDGE. I would be, I think as far as the Department of Defense is concerned, we would be very reluctant to have a new design come in with a single vehicle. As was pointed out, the orbiter works fine. There was no indication as a result of the accident that the orbiter was—has any difficulty whatsoever. We would want that degree of reliability and confidence in a follow-on vehicle. I think the Nation should look for that, and that Jesse Moore and I cochair a joint DOD-NASA study looking to the future space transportation system, a second generation system of some type. That is the focus we will be looking for, what type of vehicle we have in the late nineties to meet our space transportation needs.

Mr. BARTON. Well, I didn't mean to imply that we should completely redesign the orbiter. I just think if you're going to spend

$1½ billion to $2 billion to replace it, if there are things that you've thought well, you know, if I had to do it again I'd do it this way, you ought to look at that.

Dr. GRAHAM. Yes, sir; and in fact we looked at that not just with a potential replacement orbiter, but across the orbiter fleet. For example we have in train now a process of bringing forward a new general purpose computer for the orbiter and a new, what we call, phase II engine pump and other items which we think will substantially enhance the operations of the orbiter. These are in this long-term development/test/qualify chain and we will continue that process. So even the orbiters that you see now in fact in detail will become improved orbiters as technology advances over time.

Mr. BARTON. I've gotten the note here, I get one more question. Wait an hour and a half, and then—so I guess my last question, since I only have one more, I may cheat and ask two, but—if the full Congress and the Senate decided not to replace the orbiter, are you confident that you could continue in a prioritized fashion with the Space Program, the space station, the work that needs to be done on the strategic defense initiative and some of the other high priority areas?

Dr. GRAHAM. Well, Mr. Barton, neither NASA nor the DOD would close up shop and quit even under that circumstance, but I believe we would all be facing a substantially different space program than the one we contemplate today if we were not able to replace the capability of the orbiter that we lost.

Mr. BARTON. Mr. Aldridge.

Mr. ALDRIDGE. I agree with that. I think that would be a mistake for this country to go back to a capability that would be less than what we had before this accident started. We should be taking the opposite direction. We should be building a stronger launch capability than existed before this tragedy.

Mr. BARTON. If I could have one last comment, I would hope that the committee will look at methods to pay, Mr. Chairman, although it is probable that the taxpayer will pay, I think we are not doing our duties as Representatives if we don't explore some of the privatization alternatives. And as to having the journalist in space, I support that; that's one less phone call that I have to return if they're up there.

Thank you, Mr. Chairman.

Mr. MINETA. Dr. Graham's going to take all nominees that committee members might have for the journalist in space award.

Mr. Scheuer.

Mr. SCHEUER. Thank you very much, Mr. Chairman.

Mr. Chairman, I think there is a consensus in the Congress and in the American people that we want to go forward with space. We want to meet our, not only our military commitments but our diplomatic commitments. We're providing vitally needed information all over the world to less-developed nations. We're developing all kinds of critically needed military and security information.

I think it goes without saying that we don't intend to abdicate space to our competitors in Europe and Japan, that we're going to be in there. But I think we, all of us have had a cruel awakening to the fact that as we explore some of these enormously important public policy questions that we have been listening to this morning, hearing discussed, that probably the decisionmaking process at NASA and the degree to which NASA is encouraging expert opinion, thoughtful opinion to be produced and to come forward and be made available to its top authorities and cranked into the decisionmaking process, has been seriously flawed.

Nobody who has watched television in the last couple of days can escape having come to the conclusion that there were serious flaws in the decisionmaking process with officials involved with life and death decisions at a top level being denied or not having availed themselves of critically important data affecting their decisions.

Now as we look forward and face a whole host of public policy decisions of vital importance, how is NASA going to apply the lessons that have already been learned without waiting 120 days for the Rogers report? But the lessons are transparently clear to every American who can read the paper and watch the tube. The lessons of the flaws in the decisionmaking process and how is NASA going to come to some institutional remedies, some organizational and systematic remedies to take off the blinders get out of the tunnel vision that apparently was afflicting its top decisionmakers. And reach out across this land and get expert opinion where it was available on a continuing, systematic basis, and crank that opinion and crank the facts underlying those opinions into its decisionmaking process at a very top level.

What kind of changes do you see coming as a result of what we've learned in the past few days?

Dr. Graham. I don't want to prejudge the situation until I have seen and heard from all the parties involved, and I must admit I have been so busy myself in the last 2 days that I'm sure you have seen more of the specific testimony than I have, although I expect to become intimately familiar with it in the immediate future.

Nevertheless it seems to me that something did go wrong; the *Challenger* accident in my view should never have happened, and that we are going to have to take strong and substantial action to make sure that it never happens again.

As I mentioned, we started a program of specific design modifications already. In addition, I have instituted a review——

Mr. Scheuer. Dr. Graham, I am not talking about design modification. I'm talking about improving the quality of basic decisionmaking at NASA. It's a whole different kettle of fish I'm talking about.

Dr. Graham. I'm just going down a list of things that are in train, which is what I thought your question was. All of the category 1 and 1R reliability, critical reliability issues will be reviewed, item by item and one by one to make sure that we understand exactly what decisions were made and why, and in addition to——

Mr. Scheuer. To make sure you understand exactly what decisions were made and why they were made?

Dr. Graham. Exactly; and to make sure that we judge them in today's environment to be appropriate and if not, that we reconsider them and take whatever action necessary. In addition to that, I have started streamlining the management within the agency to make sure that the communication channels are as short as possible, and as direct as possible. And I believe that Admiral Truly, as the Director of the Office of Space Flight, is taking some similar actions within his organization. Perhaps he would like to add additional comments to that.

Admiral TRULY. I certainly would, sir. I also feel very strongly about due process, and I wouldn't comment on the situation, but——

Mr. SCHEUER. This is not a court of law. This is a congressional hearing. We're supposed to be informing ourselves and informing the public. Nobody's being tried and nobody's being——

Admiral TRULY. Yes, sir.

Mr. SCHEUER [continuing]. This is not a "Star Chamber" proceeding. All we're asking, and I'm not referring to anybody by name, I am referring to a process. The process seems in critical need of improving.

Admiral TRULY. May I answer your question, sir.

Mr. SCHEUER. Please do.

Admiral TRULY. Directly. I am going to cause a top-to-bottom review of the decisionmaking process within the agency that under my responsibilities as Associate Administrator for Space Flight goes from the plant and their oversight by the NASA centers down through the launch preparation and into the launch countdown.

It is—I'm not sure how we're going to do it, but I can assure you that that is going to happen. I guess I would only like to say, though that—and since the last few days since I've been detailed from the Navy to do this job, and I spent all day yesterday at the cape; that I am convinced that the—despite the fact that something went wrong in this decision process, that the strength of NASA is intact. And after this review, I am going to be totally confident that we have done our job to tighten it down, or I'm not going to recommend that we fly again in 6 months or 12 months or until it's done.

Mr. SCHEUER. Well, Admiral, I——

Mr. MINETA. Mr. Scheuer, may I interrupt and take the prerogative of the Chair, since the Chair is returning, but I think this is the area that Mr. Nelson had said at the beginning of the hearing that he wished to really leave to a later time.

Mr. SCHEUER. That's correct. I'm not going into the accident——

Mr. MINETA. And I think that——

Mr. SCHEUER. Mr. Chairman, I'm not going into the accident. But here we're talking about the future of NASA, and I simply want to be assured that as NASA recommends to the Congress and recommends to the American people what its future should be involving a whole myriad of very important public policy issues as well as technical decisions, that there will be improvements in its decisionmaking process and we will remedy the rather glaring defects that seem to have taken place.

I'm talking about our future and I am not at this time going over the specifics of the accident that took place.

Dr. GRAHAM. You can be absolutely assured that we are going to review and in fact are reviewing the technical and management judgment processes, the approval processes, the organizational configuration from top to bottom, and that we will give those both the attention that they deserve today and that we will not hesitate in any way to make any changes or corrections that seem to be warranted.

Mr. **Scheuer**. That's very reassuring. Your answer is reassuring and the admiral's answer is reassuring. I think that's what all of us, what the American public want to hear.

It conceivably might be that you'd want to have an ombudsman there, who would be available on a 24-hour basis for any expert, for any specialist to call in any concerns, to cut through bureaucracy, to cut through contractor bureaucracy, NASA bureaucracy and get that information in at a very top level.

There may be a lot of dross, but among the dross there might be some wheat, too. That is just an idea that comes to mind.

Let me ask one more question. We have seen in the development of very high risk and very high technology developments that it's sometimes hard to match human beings with the mission. The State of California has as its motto: "Send me men to match my mountains." Perhaps the motto of NASA should be: Send me men to match our mission.

We learned from Three Mile Island about this problem of human engineering. We didn't have a failure there of technology. What we had was a failure of people. All those backup systems worked at Three Mile Island. It was a failure of people to watch them, to interpret them, to act on them that caused the problem.

It seems that there is that problem in NASA and its contractors that has developed, and there was an accident before this one involving the solid fuel booster rocket, in November, and NASA in its own investigation of that found that, in the contractor, in the Lockheed Corp. there were problems of poor employer morale, poor employer training, lack of employer dedication, lack of employer commitment that sort of matched the kind of human problems we met with in Three Mile Island with almost disastrous results.

This is a problem that would be there had there been no *Challenger* accident. But it seems apparent to all of us that when you have the kind of a program, where mistakes are intolerable and unacceptable and that where the smallest mistake can lead to incredibly tragic consequences, that you have to seek really close to human perfection all the way along the line; and we know that's tough. We learned a lesson in Three Mile Island and we learned another lesson from NASA's own investigation of the labor situation in Lockheed.

It's obvious to me and I would think to most anybody that where you have poor employee morale and commitment and discipline and training that that's not the kind of environment in which you are going to achieve the virtual perfection that is needed in the manufacture, the installation, the maintenance, and the operation of as high risk and high technology an enterprise as space flight.

What are you doing now to face up to this engineering problem which your own people discovered, to their credit? What actions are you taking with your contractors to avoid the problems we found; the human engineering if you will, problems we found at Three Mile Island; the same problems that they found in the Lockheed contractor plant. What are you doing to make sure that we do send you men to match your mission?

Dr. **Graham**. I think of all the things that I could describe that we have underway, the most important one is that the top management of NASA, which includes Admiral Truly and myself, make sure that we put time on the factory floor, that we are there where the people are doing the work. We are knowledgeable about the environment that is in the organization, and we work to maintain exactly the quality and the spirit that you describe.

I have done that; I've done that before the accident, and I found it good and I intend to continue that process. I'm going to put a lot of my shadow on the works of NASA across the organization.

Admiral Truly comes back today from 2 days at Cape Kennedy. These were, I believe, the second and third day of his tenure at NASA. Perhaps he has something further to add in that.

Admiral TRULY. I, prior to leaving NASA just over 2 years ago, I spent 14 years in NASA in the astronaut office and in what you—what is needed is something that I think NASA attempts to do very much. I've been in every factory; I've been to every center; I've been to every program office during that period and I flew this vehicle twice.

It is necessary to continue. This is a very turbulent moment, but all I can do is pledge to you that we at the top of this agency, or at least me at the top of this part of the agency at the moment will pledge our total efforts to continue that. But space flight is made and conceived and designed and done by human beings, as you say. We think we have some of the very best, but we're not perfect.

I guess I would also say that we could scrap the shuttle and build a brand new vehicle, and that brand new vehicle, no matter how—of a totally different design, it would still be a bold endeavor, and I don't think that's going to change, and I think the American people realize that.

But I, as I've said before, this is going to be a very busy year for us as we look into all of our hardware and software problems, but also all of our processes, our human processes in design and countdown and in flight. We're prepared to do that.

Mr. SCHEUER. Admiral, I appreciate your answer and I admire your whole attitude. I think we can all take comfort from the fact that there didn't appear to be any basic design flaw in *Challenger*, or we really would be back to square one.

It was something other than design. I think you do have a problem with your labor in your contractor out there on the west coast. Has there been any systematic followup with Lockheed to see what they would propose? After all, it's their labor; they're your contractor, so although it's one systematic process, it's a continuum. Nevertheless, they're at that stage responsible for quality control and when you have unmotivated, undisciplined, untrained workers, you've got yourself one hell of a problem. And with all respect, Admiral, and with all respect, Dr. Graham, this problem is not going to be solved by an occasional visit from either of you or both of you, much as I respect you and great as the impression you would make.

This problem requires far more than in terms of institutional change out there in the Lockheed plant. Things have to be organized differently. This is a very real problem, and labor training, labor motivation, and labor morale, this is a very sophisticated problem of labor management, and I hope very much that you won't think that it will be solved by an occasional visit with a brass band and so forth—a ceremonial visit from a couple of the top NASA administrators. It obviously goes far deeper than that.

Dr. **Graham**. I hope you understand that——

Mr. **Nelson**. Excuse me, Dr. Graham. I will take the prerogative of the Chair here and make sure that the record reflects that nowhere is there any conclusion by anybody nor even any speculation that the workers so referred to are unmotivated, unskilled, and untrained as was stated by the gentleman from New York.

Mr. **Scheuer**. Mr. Chairman, I beg to differ with you. In NASA's own investigation of that November accident, it is so described.

Now, in the finding of test team No. 3——

Mr. **Mineta**. Mr. Chairman, regarding order. Again, given the admonition you gave us at the beginning of this meeting, in all due deference to the gentleman from New York, I think we ought to really be dealing with access to space and the priorities in terms of loads, the orbiter, other things, the manifest, and I'd prefer that we get away from this line of questioning at this time, and ask the chairman for regular order.

Mr. **Scheuer**. I'll accept that, Mr. Chairman, but I do want to state that the record should show that the quotes that I took and the language that I used and the words that I selected were directly taken from the NASA investigation of the accident that Lockheed published in November, of which this committee has a copy.

Mr. **Nelson**. All right, and you will have plenty of opportunity in the future, Mr. Scheuer, both privately and publicly to inquire to your satisfaction those opportunities. The instant hearing here, however, is on assured access to space and we will proceed on that basis.

Do you have any further question on that, Mr. Scheuer?

Mr. **Scheuer**. No, Mr. Chairman; I appreciate the opportunity to question, and I suggest that if we don't solve the two basic questions that I adverted to, there won't be any assured access to space and there wouldn't be any access to space at all. These are indispensable questions that must be answered, having nothing to do with the past, but they must be answered as we chart our future in space. Thank you, Mr. Chairman.

Mr. **Nelson**. Well, that's why all of us are gathered here, is the fact is that we're going to assure the access to space and we'll proceed.

Mr. Monson.

Mr. **Monson**. Thank you, Mr. Chairman. I found this to be very helpful today. I think a lot of good and necessary information has been transmitted. Just to make sure that I understand some of the things, and I hope I don't cover too much of what we've already covered, but it's my understanding that the *Atlantis* was very different from the earlier vehicles because of improvements; maybe not in looks and appearance, but in improvements especially in software.

Did those improvements cost a lot more money than earlier shuttles or, and if there were improvements in a replacement orbiter, would we expect those to be more costly as well or were these improvements such that new technology that was also preceded by the opportunity to reduce costs allowed us to produce it at relatively the same price?

Dr. **Graham**. I would like to give you in writing a detailed answer to that, Mr. Monson, but I think we should recognize that we have the advantage now of having built four orbiters, and there is necessarily a learning process associated with that which we have largely gone through. And so the efficiencies to be gained by the learning we have already accomplished would certainly be incorporated in any further orbiter construction.

Mr. **Monson**. I'd look forward to that more detailed response.

Dr. **Graham**. Yes, sir.

[The material follows:]

Orbiter 104, Atlantis, was essentially the same configuration as previous Orbiters. There were differences in structure and thermal protection systems. The software changes referred to in the testimony are not directly related to a vehicle but rather to general software changes implemented through the interchangeable General Purpose Computer (GPC). Improvements to an additional Orbiter would be compatible with ongoing fleet improvement programs.

Mr. **Monson**. As far as—the references have been made I believe it was to 24 backlog missions that would accrue between now and what is it, 3 or 4 years from now?

Dr. **Graham**. 1990, sir.

Mr. **Monson**. Are those all missions that are necessary, that require the shuttle, or could some of those be made up with ELV's?

Dr. **Graham**. No, sir; they would not all require the shuttle. Some of them would be compatible with ELV's. However, that has to be viewed within the context of the availability of ELV's as well, and just like we can't create a shuttle in 1 year, we can't create a new ELV in such a short period of time, either.

And so there's a phasing issue of ELV capability along with shuttle capability, and that's precisely the issue we're looking at now in the overall manifest.

Mr. **Monson**. And just one more question. You referring to the fact that you have seven, I believe it was seven sets of SRB's?

Dr. **Graham**. Yes, sir.

Mr. **Monson**. Currently, and that that would get us through the recovery period, I think is how you referred to it. Could you tell me what you mean by that?

Dr. **Graham**. Those are seven flight sets of the steel-cased SRB's and the question is, as I understand it was, Do we continue producing SRB's at this point in time, continue recasting the motor sections in particular or if we don't, will we have any SRB capability to fly when we come out of this hiatus? And my point was that while we're not going to cast new SRB's until we understand how they need to be made and specifically what we need to do to make sure that the *Challenger* accident never occurs again, if we can find a modification for the existing SRB's, we have seven flight sets available for potential modifications which could allow us to return to flight status with some capability in terms of our on-the-shelf hardware that we could begin flying after modifying.

Mr. **Monson**. So you would expect them to have to be modified, but—and you have also included that in the cost against what you anticipate the savings to be from not flying. Is that correct?

Dr. **Graham**. At the present moment and without the benefit of a full description of the cause of the accident, I nevertheless believe that it would be prudent to modify those SRB field joints to a different configuration. And the cost of that is roughly in the recovery figures that I stated today. Yes, sir.

Mr. MONSON. Thank you very much.

Thank you, Mr. Chairman.

Mr. NELSON. Thank you, Mr. Monson.

Mr. Mineta.

Mr. SCHEUER. Mr. Chairman.

Mr. NELSON. Yes, Mr. Scheuer.

Mr. SCHEUER. Mr. Chairman, I would ask unanimous consent that I could insert several pages of the NASA report that I referred to in the record immediately after our colloquy on the language that I used, because language that I used was taken directly from the NASA report, and I want the record to show that.

Mr. NELSON. Is it a report that deals with assured access to space?

Mr. SCHEUER. Well, it's a report that deals with an accident that happened last November in a NASA operation, and it dealt with the problems that I referred to before, and it's perfectly obvious that we all want to solve those problems; we're not trying to hide them; we're not trying to sweep them under the rug. The admiral and Dr. Graham were perfectly forthright about their absolute determination to face up to those problems and since you brought the question of my language into the public record, I'd simply like to include—there are just two or three pages in here that make it very clear that these are NASA's words and not my own; and that's a real problem that we are going to have to solve before our access to space is assured or safe, and I know that Dr. Graham and the admiral feel very strongly that we must solve them.

I just want to clear up the record that my language was from their report. The problems I referred to are from their report.

Mr. NELSON. We'll be happy to insert that.

[See Appendix No. 5.]

Mr. NELSON. Mr. Mineta.

Mr. SCHEUER. Thank you, Mr. Chairman.

Mr. MINETA. Thank you, Mr. Chairman.

Dr. Graham, let me follow up on Mr. Monson's question. Of those seven flight sets that are available, you say you will be modifying those; you think there may be a need to modify those?

Dr. GRAHAM. I'm saying that my evaluation today is that it would be prudent to modify those if, and we are working on several designs which would in fact do that and have that implemented at the earliest possible time. Yes, sir.

Mr. MINETA. And that new SRB's are not being cast?

Dr. GRAHAM. At this moment, new SRB's are not being cast. We are holding that production pending further evaluation of the *Challenger* accident.

Mr. MINETA. And are you negotiating right now with Morton Thiokol on further orders—what I'm trying to get at, I guess, is where are we with regard to the second-sourcing as it relates to UTC, Aerojet, and Hercules and given that second-sourcing, are there any negotiations going on with Morton Thiokol for further orders and because if that is going on, I would wonder why that procedure is being followed.

Dr. **Graham**. Since any is a comprehensive word, let me respond to you for the record, if I may, to tell you exactly what the status of discussions is at this point, and where we stand on the second-sourcing. Our fundamental thrust is, we're looking toward seeing if there is a budgetarilyviable way that we can acquire a second source for supply of SRB motors.

[The material follows:]

The following material on Second Sourcing of Solid Rocket Boosters/Solid Rocket Motors, is the most current assessment.

2nd Source Status

The decision to proceed with a SRM second source initiative with specific conditions was made on December 24, 1985. The four contractors that have expressed an interest were informed by letter with additional information relative to the NASA conditions and planning for a RFP. They were also asked to submit questions that they may have by February 12, 1986. The contractors were to respond by March 12, 1986 with an expression of interest, after reviewing NASA's response to all questions submitted. A "services sought" announcement also appeared in the Commerce Business Daily on February 7, 1986.

Because of the 51-L disaster, and the resulting support required from key NASA propulsion personnel, the contractors were informed verbally, and in writing, of a delay in responding to their questions. This delay will provide an opportunity for NASA to reassess the impact of 51-L on overall schedules and conditions for second source.

Negotiations with Morton Thiokol for the next sixty SRM's (with an option for an additional thirty) were resumed after an interruption following the 51-L disaster. MSFC has been instructed to proceed to finalizing negotiations. However, no contract will be signed until the impact of 51-L can be fully assessed.

Mr. **Mineta**. But aren't those companies putting up front their own moneys for the second-sourcing?

Dr. **Graham**. I don't believe anyone has yet made a specific commitment, but I believe within the budgetary climate that we're in today even preaccident, that would be a necessity to develop the second-source.

Mr. **Mineta**. In Secretary Aldridge's statement there is a strong endorsement of procurement of a replacement orbiter. You, in your statement, have nothing on the second orbiter, but you did endorse Secretary Aldridge's statement.

I assume that your statement is cleared by OMB. Your verbal response is a personal one?

Dr. **Graham**. My verbal response is my response as the Acting Administrator of NASA, which is certainly more than personal. On the other hand, there is not yet, as Secretary Aldridge indicated, a coordinated Administration position on how to proceed. We're working at a very high rate to arrive at that position and hope to present that to you in the very near future.

Mr. **Mineta**. Any time as to when that near future might be?

Dr. **Graham**. That requires me to predict the response of a number of agencies other than NASA, and I can do that with only a limited fidelity, but I would look to the next few weeks.

Secretary Aldridge.

Mr. **Aldridge**. I'd support that timeframe.

Mr. **Mineta**. And any idea as to how or what framework that request would come to us? One of the concerns I have is that if we have a freestanding bill, I don't know how many votes we'll get for it. I'll vote for it, but I don't know, of the 435 colleagues, how many votes we're going to get. And so that's why I'm trying to fish around.

One of the areas I'd like to consider is for instance the reconciliation bill. If that's going to move, here's a bill that's going to be roughly $7 billion. I think we can give members coverage or cover by saying we'll take $2.2 billion of that $7 billion saving for the replacement orbiter.

It just seems to me that we ought to be moving on this as quickly as possible. Having served over 7 years on the Intelligence Committee before I had to come off this year, as Secretary Aldridge knows, because of the limitation in the number of years that we can serve on that committee, I just am really concerned about the whole space—I mean, the space shuttle, ELV issue and I have no question that we've got to move forward on an orbiter.

And that's my only expression of this kind of caution that I'm getting from your response.

Dr. GRAHAM. Please don't interpret a hesitancy on my part with the fact that the Administration has not yet finalized its view on this.

Under the strong guidance of the President the interagency process is proceeding at a faster pace than I have ever seen it move before, and it's proceeding with better cooperation among the various agencies than I have ever seen before in the process, and I've looked to coming back to you in the very near future along with Secretary Aldridge to present the specific Administration position on this.

Mr. MINETA. Given the concern that was expressed about whether or not the orbiter is being updated or retrofitted in any way from the first orbiter to the fourth and then now with the talk about the replacement orbiter and whether or not that would be upgraded to state-of-the-art technology, I'm wondering whether or not during this downtime, whether NASA has considered doing anything with the support facilities such as Mission Control or any other area where you may want to be doing some work to upgrade those facilities during this time period.

Dr. GRAHAM. Yes, sir; we are looking at that and in addition, we're using those support facilities for not only training but for doing things such as the integration and tanking tests on the Centaur system when it's installed in the shuttle, and a number of activities that are productive in this interim period.

We will pursue that and pursue any additional work that needs to be done on the orbiter fleet during this period to the greatest extent possible.

Mr. MINETA. Also with regard to a previous question when talking about prioritization of loads, you had said that 12 to 18 flights would be needed just for space station?

Dr. GRAHAM. Yes, sir. Our current estimate is 12 flights over an 18-month-to-2-year period.

Mr. MINETA. So it seems to me just in terms of Mr. Barton's question your manifest schedule is pretty full, is it not?

Dr. GRAHAM. Yes, sir; it was a full manifest before the *Challenger* accident out through the mid-1990's.

Mr. MINETA. Then how do you determine what the priority order of your payloads will be in terms of science needs, commercial needs, DOD payloads? Would commercial users be bumped in the near term because of the priorities, or would you develop a plan based on essential needs regardless of who the original user is?

Dr. **Graham**. We will try, in fact are now developing a manifest in conjunction with the other agencies of the Government and the other users of the shuttle system, the scientific community, the international community, the commercial community to try to develop an overall manifest which reflects our priorities, reflects the unique capabilities of the shuttle, and reflects the ability of other launch vehicles, ELV's, to carry some of the payloads.

As we work that through, our general guidance is the President's space policy which designates, of course, critical national security payloads as the No. 1 priority, and then proceeds from there as I've described. And it's our job to establish a new manifest within the limited constraints and less than was previously available launch capabilities that attempts to accommodate to the highest degree possible the needs of all the users of the shuttle system, either by having them on the shuttle system or helping to direct them to other launch capabilities that would be adequate for their purposes.

Mr. **Aldridge**. Mr. Mineta, as far as the Department of Defense is concerned, of course within the next 2 years is, as I mentioned, there's nothing we can do but live with whatever delays are incurred. But we're looking at those payloads that could be easily removed from the shuttle manifest, 2 to 3 years from now, and placed on ELV, so that we're not abandoning the shuttle. We don't want to do that because many of those payloads are uniquely designed to fly on the orbiter, but we do feel the necessity to try to ease the burden on NASA so that many of the scientific and commercial payloads could still be launched and where we could take off some of that burden with expendable launch vehicles; and we're looking at that, as Dr. Graham mentioned. That's a joint effort to make sure that those can be done easily and when in fact, if NASA finds that because of DOD priority they do experience some pain of getting a particular flight off, we negotiate that and see if we can slip a little or whatever. And that's just, as a process is ongoing right now.

Mr. **Mineta**. Now in terms of the commercial payloads that you sign, how far into the future are those commitments?

Dr. **Graham**. I'd like to ask Mr. Lee to address that.

Mr. **Lee**. Mr. Mineta, our commitments that we have today to the foreign and commercial extend into 1991 area.

Mr. **Mineta**. And what is the nature of, if we have any escape clauses so to speak, from those?

Mr. **Lee**. Our launch service agreements have a clause that if we are unable to meet the firm launch dates in the launch service agreement or our contract, that within 9 months they are free to walk away with, reimburse their payments that they had made to NASA.

I might add that this doesn't always help them because there—we do have two—the problem can be divided into two. It's a near-term problem and a long-term problem. You've been discussing ELV's, and I think the near-term problem is brought about by the lack of available ELV's. Capacity, as Dr. Graham addressed earlier, and the capability. In some cases the current ELV's that might be produced in 36 months don't necessarily meet the lift capability of some of our payloads.

Mr. Mineta. Is there any policy as to whether or not we should be buying the ELV's through a supplier or directly from a manufacturer?

Mr. Aldridge. Let me make sure I understand that. We have a contract through the Air Force for the complementary ELV program through Martin-Marietta directly. It is a direct contract to us to supply those boosters for Air Force launch with obviously a heavy contractor team participating in the launch.

I'm not sure if that answered your question—a commercial-like venture?

Mr. Mineta. That's right. For those vehicles which are supplied by a commercial vendor, is that something that we buy through the manufacturer directly or through the——

Mr. Aldridge. We buy the complementary ELV directly from the manufacturer, which is Martin-Marietta, and of course they have associated subcontractors participating in that design. As you may recall, we were talking about 2 years ago doing some type of commercial venture that the Congress disapproved, as well as the funding associated with it, and forced the Department of Defense to go through a normal procurement practice with that.

Mr. Mineta. Let me ask specifically on the Delta, where we have a commercial supplier different from the manufacturer. Should we be going directly or still be getting it through the the supplier?

Dr. Graham. We are basically in a preliminary stage of an arrangement with a potential supplier for the Delta, and there are a number of milestones to be accomplished, if that process is to be brought to completion.

The accomplishment of those milestones is another way of viewing a possible transition period from the situation we're in now where the Government has been buying directly from the manufacturer and the Government has been assuming all the risk in the operation of the ELV's to a possible situation where a commercial supplier provides them as a package, and assumes substantial parts of the risk for the operation.

The general policy that the President has laid down is to encourage the commercialization and commercial aspects of space across a broad range of activities, and we would of course work to that policy but as always within the range, within the constraints of budgetary and fiscal responsibility and seeing that the rewards have associated risks, which is what in fact makes a commercial enterprise.

Mr. Mineta. Let me thank all of you. Thank you, Mr. Chairman.

Mr. Nelson. Mr. Andrews.

Mr. Andrews. I'd like to follow up for a second on a line of questioning that Norm covered. Mr. Secretary, let's think about long-term consequences, should we not be able to move quickly to an additional orbiter.

As I understand it, you really have two alternatives, if that's the case. The first is you can use your prerogatives to bump nonmilitary missions, payloads, off an orbiter.

Mr. Aldridge. That's correct.

Mr. ANDREWS. That's one alternative. But let's assume that it's not politically feasible or realistic that you'll be able to do everything you want to do, because surely I think you would agree that you wouldn't be able to exercise that policy; that policy would not be exercised to the fullest extent.

Mr. ALDRIDGE. My testimony pointed out that type of policy is not in the national interest.

Mr. ANDREWS. All right. So the second alternative that you have is to transfer to ELV's. You then recognize that you can't do it all; as a matter of fact, you're going to have to transfer a lot to ELV's, if that's the case.

And my question really is, tell us, if you would, what the expense could mean to the Department of Defense and tell the committee if the Air Force has done some analysis of the consequences of these kinds of costs.

Mr. ALDRIDGE. I can't give you a precise number at this point. This is part of the interagency process that is ongoing. And the reason is, it's—I can give you various degrees of transfer. We could take, because of the CELV Program which was approved, we could essentially take everything off the orbiter, and fly all ELV's sometime in the future. That will take us a lot of money, a lot of time, and a tremendous expense.

That's obviously a choice that we would have, and that's not the right choice. The choice is, as I mentioned in the testimony, is a balanced approach. Let's keep those payloads on the orbiter; they make sense, and those which we can easily, inexpensively, and rapidly transfer to ELV's, let's look at those. And that's the process that's ongoing right now.

I can tell you in general nature it is clear that that analysis will result in some increase in the number of ELV's that the DOD will request. We have approval now for 10 complementary ELV's, flying at a rate of about 2 per year from 1988 through 1993, 1992, or 1993; that was approved by the Congress. Those are ELV's, what we call the Titan 34D7 that are capable of launching the same size and shape and weight as the shuttle is capable of launching. We fly those only out of the Eastern test range, out of Cape Kennedy.

We have approval for 13, to modify 13 Titan II's to space launch vehicles. It is clear that the analysis will say we need to expand the launch capacity beyond the 13 that we currently have. How many, at what rate; we're looking at that at this point.

And it is also clear we probably will need to expand the existing ELV capacity; such as Atlases or Titan 34D's, the current Titan's that are flying today. How many those are, I can't tell you right now because we're looking at the precise dates which they could become available, the payloads which could be flown, the cost of modifying the payloads that will come off the orbiter to fly that particular 34D, and, of course, the cost of providing the additional launch capacity offset by the cost of the shuttle ride that we had anticipated.

All that analysis is now being folded together so that the dollar numbers and what's required in 1986 is still elusive at this point and we hoped all that would be focused in a couple weeks where we can tell you.

It is clear expanded ELV capacity over that which is currently approved is obvious to me in any event.

Mr. **Andrews**. Well, I would encourage you to get that to us. I think as the debate proceeds on the need for an additional orbiter, that issue can be a very critical one.

Mr. **Aldridge**. My personal view is that it's not either/or. It's both.

The other point I could make on this is that when we do look, which gets into this commercial idea, when we do look at expanding the ELV capacity required by the Department of Defense, that the incentives now and the cost of the additional capability for commercial versions of those vehicles looks very attractive. When we're talking about only producing two of these per year, the cost per unit is pretty expensive. If you're going to increase that by some substantial margin, then the commercial attractiveness of that venture to add on for commercial launches, since the Government is basically paying for that overhead, the basic overhead rate, looks very attractive.

Mr. **Andrews**. Thank you.

Thank you, Mr. Chairman.

Mr. **Nelson**. Let me just have a couple cleanup questions here, and I'm mindful of your time and I'm mindful that the hour has approached noon; and it's my intention to keep us according to schedule. Allow me just a couple more minutes here for some cleanup questions.

As you look to the future, how frequent do you think that an orbiter would have to be rotated out of service for long-term overhaul and maintenance?

Dr. **Graham**. That will depend in part, Mr. Chairman, on the information that we learn as we go through the operation of the orbiter fleet.

We are going to do as much of the maintenance as we possibly can in sequence with the launch program so that we don't have to withdraw orbiters for long periods of time. But there will almost certainly come instances when we have to do major overhauls or maintenance which will require some reduction of schedule. We will try to build those into the manifest and we hope it's on at most a once-every-few-years basis; but our operational history to date isn't sufficiently extensive to indicate the precise time.

Mr. **Nelson**. OK. Let's keep that question very fresh in our minds as we analyze. What's the frequency and what is the downtime of the frequency for overhaul and maintenance as we go about in this discussion of launch capacity?

Now, I can't recall if we really addressed this issue. I don't think we did. We've talked about a mix of ELV's and so forth, but let's assume no additional ELV's. Could orbiters alone be capable of servicing what we anticipate to be the backlog?

Dr. **Graham**. Go ahead.

Mr. **Aldridge**. Let's talk about it just from the DOD perspective for a second. The facts are that we had planned an average of nine flights a year and that was pretty firm flights; there were some that were over and above that which raised the number, as you mentioned earlier, to as high as 11 per year of DOD missions alone.

That did not account for any downtime period of DOD missions that would result from this, this year hiatus. If you said we could not have any further ELV's other than the ones we've already approved, we would require the orbiter fleet to fly 9 to 11 missions a year and then try to work the backlog off, whatever that backlog would be, depending on the downtime; and I think for a year I believe we said it was 10 DOD payloads—now, those are in various configurations, some of which could be flown two or three at a time.

But that would be the kind of a mission model that would exist with DOD having to live with a three-orbiter fleet, of which only two, now, can fly the DOD missions; not three; two. And I think that would place a severe strain on the NASA commercial, foreign, and the scientific payloads.

Mr. Nelson. Yes; and you made that point very well. And you made that point that you did not want to impinge upon NASA's scientific missions or NASA's commercial missions or NASA's future ability to build and then service the space station.

Mr. Aldridge. From a DOD point of view, we could live with that; it would be reluctantly. From a national perspective, I think it would be dead wrong.

Mr. Nelson. All right. Let's talk about the ELV's. What's the earliest that the ELV production lines in the United States, that a stream of new vehicles could start flowing off those production lines? Not just one or two put together with spare parts; but a stream of new vehicles.

Mr. Aldridge. Well, let me talk from the CELV point of view, because that's the one we started 2 years ago. If we hadn't started that 2 years ago, we'd be 4 years away from having a capability at the earliest. Now we're about 2½. We could launch in October 1988 with the first CELV. There's probably not any way to accelerate that timeframe, but we could accelerate the production rate thereafter to roughly on the order of four per year; something in that order. That could be done with probably some small amount of long lead in the 1986 budget to ensure the production rate.

So 2½ years, CELV. On the Titan 34D's, which are the ones flying now, of course that production line is essentially started down because we basically had finished those. We could reinstitute that. The timeframe runs between 2 and 3 years depending on what kind of priority and how that could interface with the CELV production line; and that, the reason I can't be as precise is because that's one of the questions we've got out in the industry now, to see what could be done.

The Titan II's, of course we got those approved, and at a rate of about 2 per year, so those will fly in early 1988 as it stands right now, and of course we have 13 approved; we have 46 still in the barn that could be accelerated.

Now, the Atlas line, of course is phasing down; all the Atlas-Es, the old wheat field Atlases, are all spoken for, the remaining ones; all the Titan-34D's that are existing are all spoken for and there's no way to use those vehicles. But I believe you could probably get an Atlas ELV online in probably 3 or 4 years. It's a little bit further behind—a modified Atlas of some sort that could lift the DOD payloads.

All these numbers are again, very loose at this point because these are all questions we're trying to gather up as part of this study that we're undertaking.

Mr. NELSON. All right, if you start stoking up these ELV production lines, then does that change the equation with regard to a potential competitor to the Ariane or any other nation's commercial launcher for commercial satellites. Does that change the equation on the commercial viability of such an American ELV?

Mr. ALDRIDGE. Yes, sir; I believe it does. We get the production rate to an economic level for the vehicles and allows, then, the industry to have a very low unit cost per flight.

In addition to that, the Air Force, because of the President's commercialization of space policy, in particular expendable launch vehicles; we've made it also very attractive for whatever industry would like to venture into that area to use the launch facilities at a very economical rate. We've basically paid for the operations; we've paid for the pads; they're available to them, and we've allowed them to go in there and use those pads for commercial purposes based upon what we call a direct cost, which is just the incremental cost to fly, which is a very small dollar amount. We've already pursued that effort, and I believe it makes it a very attractive one for the future.

Dr. GRAHAM. Yes, sir. NASA concurs with that and would include that in what I called earlier a transition process, where we go from our present status to what we hope will be a commercially viable and healthy ELV capability.

Mr. NELSON. All right, we will submit some additional questions that we've just flat run out of time for.

[See Appendices, p. 668.]

Thank you very much. Do either one of you have any additional comment?

Mr. ALDRIDGE. I hope the comments regarding no journalist in space does not apply to Under Secretaries.

Mr. NELSON. As a matter of fact, I overheard a comment here at the table that said, well, they had some recommendations on who ought to be the journalist.

You all have been terrific. We appreciate it. Thank you for coming, being with us. The meeting is adjourned.

[Whereupon, at 12:15 p.m., the subcommittee was adjourned.]

ASSURED ACCESS TO SPACE

THURSDAY, MARCH 6, 1986

House of Representatives,
Committee on Science and Technology,
Subcommittee on Space Science and Applications,
Washington, DC.

The subcommittee met, pursuant to call, at 2:20 p.m., in room 2325, Rayburn House Office Building, Hon. Bill Nelson (chairman of the subcommittee) presiding.

Mr. Nelson. We apologize for starting a few minutes late, but as is the custom that we find ourselves, always when something starts, the bells ring and we have to go run to vote. We anticipate that this hearing will be interrupted by another vote, perhaps two, but hopefully that will occur in 1½ or 2 hours, so we will be well on our way.

Today is the second of 3 days of hearings on the question of assured access to space. The intent of these hearings is for us to explore different alternatives as we look to our space launch capacity, particularly in light of the tragic loss of one-quarter of our space shuttle fleet.

Last week, we learned that both NASA and the Air Force agree that it is imperative that NASA procure a space shuttle orbiter to replace *Challenger*. Now, they also agree that over the near term, this country is going to have to substantially increase its stable of expendable launch vehicles. This will be required, so the testimony was stated, in order to service the huge backlog of satellites that will be accumulated while we continue this examination of what was the problem in the tragic explosion, and go about fixing it.

Now, today this hearing has been designed so that we hear from the private sector. We are going to have testimony from representatives of companies that are attempting to market expendable launch vehicles. These include Dr. Lovelace, vice president and general manager of a division of General Dynamics; Deke Slayton, president of Space Services, Inc. We have also invited Transpace Carriers, Inc., to participate but they were unable to be here today, so we are going to schedule them for a later time.

This subcommittee continues to be supportive of the efforts by the private sector to develop a viable commercial ELV industry. One consequence, per chance, of this *Challenger* tragedy, that people are going to get out some very sharp pencils and determine if it is a commercially viable alternative of having, over the course of the next decade and a half, the question of a commercial ELV industry. The opportunity is certainly there and I have encouraged the private sector to really get out their sharp pencils and examine that particular opportunity.

Now later on today we are going to hear from representatives of firms from the communications satellite industry: Dr. Waylan, president of GTE Spacenet, and Mr. Hoernig, a vice president for the American Satellite Co. These gentlemen are going to share with us their concerns regarding the postaccident launch vehicle decisions that their firms must make as they make decisions over the coming months. So I want to thank each of you for being with us today.

We will have inserted in the record my ranking member's testimony, Mr. Walker.

[The prepared opening statement of Mr. Walker follows:]

OPENING REMARKS
REPRESENTATIVE ROBERT S. WALKER
MARCH 6, 1986

GOOD AFTERNOON, MR. CHAIRMAN. LET ME JOIN YOU IN WELCOMING OUR WITNESSES HERE TODAY.

AS THE CHAIRMAN HAS POINTED OUT, THIS IS ANOTHER IN A SERIES OF HEARINGS THIS SUBCOMMITTEE HAS HELD OVER THE PAST YEAR TO EXPLORE BOTH OUR NATIONAL LAUNCH REQUIREMENTS AND OUR ABILITY TO MEET THOSE REQUIREMENTS.

FOR SEVERAL YEARS, I HAVE FELT QUITE STRONGLY THAT THIS NATION CONTINUES TO NEED A COMMERCIALLY VIABLE ELV INDUSTRY. OUR POLICY OF TOTAL RELIANCE ON A MANNED SYSTEM FOR ACCESS TO SPACE WAS ALWAYS FLAWED AND NOW WE ARE PAYING A TERRIBLE PRICE FOR THAT RELIANCE.

WE ALL MOURN THE LOSS OF CHALLENGER AND HER CREW. WE SHALL ALWAYS REMEMBER THEM. BUT LIFE GOES ON AND WE MUST NOW FOCUS OUR EFFORTS ON FINDING THE CAUSES OF THE ACCIDENT, IDENTIFYING THE REPAIRS REQUIRED, AND MOVING FORWARD ONCE AGAIN.

ONE OF THE THINGS WE WILL EXAMINE IN DETAIL IS THE REQUIREMENT FOR A MIXED FLEET OF ORBITERS AND ELVS TO ASSURE THIS NATION THE ABILITY TO LAUNCH ESSENTIAL PAYLOADS IN A TIMELY MANNER.

FOR SOME TIME, I HAVE ADVOCATED POLICIES THAT WOULD CREATE AN ATMOSPHERE IN WHICH OUR DOMESTIC ELV INDUSTRY COULD COMPETE IN THE WORLD MARKETPLACE. LAST YEAR, WE CRAFTED A STS PRICING POLICY WHICH WAS SPECIFICALLY DESIGNED TO PROVIDE SOME PRICING FLEXIBILITY TO ALLOW ELVS TO COMPETE.

LAST WEEK, WE WERE TOLD BY BOTH THE AIR FORCE, AND NASA, THAT THE LOSS OF CHALLENGER WILL CAUSE SOME MAJOR BACKLOGS IN THE SHUTTLE MANIFEST AND THAT ELVS ARE THE BEST METHOD TO ADDRESS REDUCING THAT BACKLOG.

IT APPEARS TO ME THAT WE MAY WELL DECIDE TO PROVIDE A NUMBER OF ELV LAUNCHES OVER THE NEXT FIVE OR TEN YEARS FOR GOVERNMENT PAYLOADS, AND THAT THOSE LAUNCHES MIGHT WELL PROVIDE THE INDUSTRIAL BASE FOR COMMERCIAL SUCCESS OF DOMESTIC ELVS.

MR. CHAIRMAN, I CANNOT STRESS TOO STRONGLY HOW IMPORTANT THIS AREA OF COMMERCIALIZATION WILL BE TO THIS COUNTRY. WE ARE IN THE PROCESS RIGHT NOW OF MAKING DECISIONS WHICH WILL EFFECT THE SPACE INFRASTRUCTURE OF THE NEXT FEW DECADES. WE NEED A STRONG AND VIABLE SPACE INDUSTRY FOR THE FUTURE AND THAT GOAL CAN BE BEST ACHIEVED IF WE HAVE OUR DOMESTIC AEROSPACE INDUSTRY FULLY INVOLVED IN BUILDING AND LAUNCHING COMMERCIAL SPACE VENTURES IN THE MARKETPLACE.

Mr. NELSON. Let us proceed.

Dr. Lovelace, we will start with you and then Mr. Slayton.

STATEMENTS OF DR. ALAN M. LOVELACE, VICE PRESIDENT AND GENERAL MANAGER, GENERAL DYNAMICS CORP., SPACE SYSTEMS DIVISION, AND DONALD K. (DEKE) SLAYTON, PRESIDENT, SPACE SERVICES INC. OF AMERICA [SSI]

Dr. LOVELACE. Thank you, Mr. Chairman. I appreciate the invitation extended to me to appear before your subcommittee today. I know I share your deep sense of regret concerning the circumstances that necessitates this committee's examination of replacing lost launch capacity and assured access to space.

I commend you, Mr. Chairman, and your committee for the continued commitment to the United States preeminence in space. With your permission, Mr. Chairman, I would like to highlight my statement and submit the complete statement for the record.

Mr. NELSON. Indeed, you know our modus operandi here, and that is what we prefer, so thank you very much.

Dr. LOVELACE. Thank you.

The committee has requested our view regarding the scope of the problem as well as information pertaining to the government purchase of expendable launch vehicles.

Subsequent to the *Challenger* accident it became readily apparent to us, and I am sure others, that there would be a national space launch capacity problem and it was our goal to offer, if we could, constructive alternatives to help diminish that problem. Accordingly, the space systems division of General Dynamics undertook an independent study to determine the effect of the *Challenger* loss on our space launch capacity.

In this analysis we assumed a three shuttle orbiter fleet would come back on line and could fly an instantaneous rate of 14 missions per year as soon as that system came back on line.

The first significant result of our analysis indicated that the shuttle launch capacity is more sensitive to the lowered shuttle flight rate and orbiter availability than to the length of the time that the fleet is grounded, at least to the cases that we looked at, which were 6, 12 and 18 months.

The assumptions used in our study indicated that the 1986 to 1989 manifest dislocation is severe enough to suggest that the majority of missions which can now be flown by the shuttle will be limited to those that can only be flown on the shuttle.

Our analysis further indicates that a large percentage of the displaced DOD or communication satellite missions that are not "shuttle-unique" cannot be accommodated in this timeframe.

Mr. Chairman, based on the results of our study, it is our firm belief that if the U.S. space program is to meet its current commitments, Government procurement of a diversified fleet of expendable launch vehicles is absolutely essential.

The strategy should address the long-term objectives of assuring our access to space and maintaining the industrial base needed to continue assured access beyond the near term.

I emphasize the word "continuing" because a stop-gap program to simply solve our immediate problem will not address the fundamental issue, which is to avoid disruption to our national launch capabilities in the future.

I would also emphasize the word "diverse," because it is clear that the way to protect ourselves against a recurrence of this situation is to have multiple capabilities where the country is not dependent on any one single system or manufacturer for its entire space launch capability.

The essence of this robust launch vehicle fleet is the diverse industrial base through which it is provided. It should consist of the shuttle and a variety of different expendable launch vehicles and matrixed across several manufacturers.

This total stable of vehicles should be offered through a single pricing policy which is transparent to the specific launch vehicle selected. The new price should be targeted to provide a basis for transition to commercial launch services soon after completion of NASA's obligations under the current manifest of launch customers.

We have assessed our own capability to help replace lost launch capability. I am pleased to report to the committee that resources do exist in at least four major areas which would enable us, if called upon, to help meet the country's critical launch requirements. These major areas are: First, an existing inventory of launch vehicles; second, an existing production line to manufacture additional launch vehicles; third, an existing group of operational launch complexes from which to fly the missions, and fourth, an existing team of experienced management technical and launch services personnel to staff a substantial program.

Regarding the first of these areas, existing launch vehicles, there are currently both Atlas and Atlas/Centaurs coming off the production line. Three Atlas/Centaurs are currently planned to be delivered for launches starting in 1986 with the Navy fleet FLTSAT COM satellites. In addition, there remains one Atlas-H vehicle which is ready for launch, and 12 Atlas-E's to be refurbished for launch from the Vandenberg Air Force Base.

Second, in the area of production capability, we have the only existing operational production lines to produce additional medium size launch vehicles in this country. It is our belief we have the current capacity to build three Atlas or Atlas/Centaur's in 1988, and five each in the years 1989 through 1992.

Some additional investment in rate tooling and facilities could relieve manufacturing and launch operations choke points, and lead to production of 3 Atlas or Atlas/Centaur's in 1988, 9 in 1989 and reach a level of 17 per year in 1990.

The most critical spare asset for making that launch, as well as the most time-sensitive, long-lead item we must procure, is the Rocketdyne MA-5 engines. Our normal production leadtime to launch of an Atlas/Centaur is somewhere in the 30- to 36-month period.

We have begun early manufacturing planning in conjunction with Rocketdyne to assure this schedule will be attained. With additional capital investment, Atlas production rate is not a constraint. Above 15 launches per year, pad facilities become the main constraint.

Future production of the Centaur upper-stage vehicle can also be accelerated by the addition of more facilities, thus expediting production of Titan/Centaur and Atlas, as well as the shuttle/Centaur. Our total current production and launch capacity for Centaur is two in 1986, four in 1987, three in 1988, and five per year from 1989 on. Additional tooling would increase our launch availability from 3 to 5 in 1988, and from 5 to 10 in 1989, and 5 to 16 beyond the year 1990.

The third area where substantial existing assets can be drawn upon is in launch sites. Three existing launch sites, two at Vandenberg Air Force Base and one at Cape Canaveral, currently support Atlas and Atlas launches. Two other complexes at the cape could be reactivated. These are launch complex 36A and launch complex 13, both of which would support Atlas and Atlas-G/Centaur.

Complex 36A is currently used for the shuttle/Centaur testing, but this operation could be moved to another location. Launch complex 13 could be refurbished and reactivated for Atlas and/or Atlas-G/Centaur launches. One launch pad at Vandenberg Air Force Base is scheduled through the early 1990's to accommodate the remaining 12 Atlas-E launches. The other launch pad at Vandenberg Air Force Base, configured for the Atlas-H, has only one remaining mission scheduled and could be available for additional polar orbital missions for DOD and civilian launches.

The fourth and final resource which we have on hand today is perhaps the most important of all, and that is the existence of the team of dedicated and experienced management and technical personnel who have made the Atlas family of launch vehicles one of the most successful space programs in the world over a quarter of a century. To date, 486 Atlases have been flown. These missions have started and included the early manned missions, scientific payloads, planetary payloads, meteorological, Navstar, global positioning, and commercial communications satellites, just to mention a few.

The purpose of a multilaunch vehicle approach is to make the space shuttle more available for national priority missions while providing reliable U.S. launch capacity for a diverse user community. We regret, as do all Americans, the *Challenger's* tragedy and the loss of the seven brave and dedicated crewmembers. We believe the shuttle capacity should be replenished.

The next generation of space exploration, the space station, the space defense initiatives, and the programs which are to follow, can only be made possible through the existence of a practical shuttle fleet to provide manned access to near-Earth space and some day to the planets.

The Atlas and Atlas family of vehicles can accommodate the majority of communications satellites at significant launch rates to make the space shuttle available for national priority programs.

In that regard, Mr. Chairman, I would recommend the reconstitution of the Nation's space launch capabilities to ensure a robust system constituted of the shuttle and selected expendable launch vehicles with a corresponding industrial base in order to support the country's needs. The overall objectives of our space program depend upon our ability to conduct space launches.

I want to thank you for affording me this opportunity to express my views and later I will be happy to answer any questions.

Mr. **Nelson**. Thank you, Dr. Lovelace.

[The prepared statement of Dr. Lovelace follows:]

STATEMENT OF
ALAN M. LOVELACE
VICE PRESIDENT AND GENERAL MANAGER
GENERAL DYNAMICS CORPORATION
SPACE SYSTEMS DIVISION

Before the
SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
March 6, 1986

MR. CHAIRMAN, I APPRECIATE THE INVITATION EXTENDED ME TO APPEAR BEFORE YOUR SUBCOMMITTEE TODAY. I SHARE YOUR DEEP SENSE OF REGRET CONCERNING THE CIRCUMSTANCES THAT NECESSITATE THIS COMMITTEE'S EXAMINATION OF REPLACING LOST LAUNCH CAPACITY AND ASSURED ACCESS TO SPACE. I COMMEND YOU, MR. CHAIRMAN, AND YOUR COMMITTEE FOR THE CONTINUED COMMITMENT TO UNITED STATES PREEMINENCE IN SPACE. THAT COMMITMENT BECOMES CRITICAL IN TIMES SUCH AS THESE.

THE COMMITTEE HAS REQUESTED OUR VIEW REGARDING THE SCOPE OF THE PROBLEM AS WELL AS INFORMATION PERTAINING TO THE GOVERNMENT PURCHASE OF EXPENDABLE LAUNCH VEHICLES. THE COMMITTEE HAS ALSO REQUESTED INFORMATION SUCH AS THE TIME REQUIRED TO BUILD AND LAUNCH ATLAS's AND ATLAS/CENTAUR's.

SUBSEQUENT TO THE CHALLENGER ACCIDENT IT BECAME READILY APPARENT TO US THERE WOULD BE A NATIONAL SPACE LAUNCH CAPACITY PROBLEM AND IT WAS OUR GOAL TO OFFER CONSTRUCTIVE ALTERNATIVES TO HELP DIMINISH THIS PROBLEM. ACCORDINGLY, THE SPACE SYSTEMS DIVISION OF GENERAL DYNAMICS UNDERTOOK AN INDEPENDENT STUDY TO DETERMINE THE EFFECT OF THE CHALLENGER LOSS ON OUR SPACE LAUNCH CAPACITY.

WE COMMENCED OUR ANALYSIS BY ASSUMING THE SHUTTLE ORBITER FLEET WOULD BE GROUNDED FOR EITHER SIX, TWELVE, OR EIGHTEEN MONTHS. WE ASSUMED A THREE SHUTTLE ORBITER FLEET COULD FLY AT A RATE OF FOURTEEN MISSIONS PER YEAR AS SOON AS THE SYSTEM CAME BACK ON LINE. THE ASSUMED ABILITY TO ACHIEVE AN INSTANTANEOUS RATE OF 14 FLIGHTS A YEAR MAY TEND TO UNDERSTATE THE NEAR TERM BACKLOG.

THE FIRST SIGNIFICANT RESULT OF OUR ANALYSIS INDICATES THE SHUTTLE LAUNCH CAPACITY IS MORE SENSITIVE TO THE LOWERED SHUTTLE FLIGHT RATE THAN BY THE LENGTH OF TIME THE FLEET IS GROUNDED. IN OTHER WORDS IT MAKES LESS DIFFERENCE THAT THE SHUTTLE IS DOWN SIX, TWELVE OR EIGHTEEN MONTHS THAN THE FACT THAT THE FLIGHT RATE HAS BEEN REDUCED BY EITHER FEWER ORBITERS OR LOWER LAUNCH RATES OR BOTH.

THE ASSUMPTIONS USED IN OUR STUDY INDICATE THAT THE 1986-1989 MANIFEST DISLOCATION IS SEVERE ENOUGH TO SUGGEST THAT THE MAJORITY OF MISSIONS WHICH CAN NOW BE FLOWN BY THE SHUTTLE WILL BE LIMITED TO THOSE THAT CAN ONLY BE FLOWN ON THE SHUTTLE. OUR ANALYSIS INDICATES THAT A LARGE PERCENTAGE OF THE DISPLACED DoD OR COMMUNICATION SATELLITE MISSIONS THAT ARE NOT "SHUTTLE-UNIQUE" CANNOT BE ACCOMMODATED IN THIS TIMEFRAME. FINALLY, OUR STUDY CLEARLY IDENTIFIES A SUBSTANTIAL BACKLOG OF PAYLOADS IN THE SHUTTLE MANIFEST WHICH ARE CANDIDATES FOR ALTERNATIVE LAUNCH VEHICLES.

MISTER CHAIRMAN, BASED ON THE RESULTS OF OUR STUDY, IT IS OUR FIRM BELIEF THAT IF THE UNITED STATES SPACE PROGRAM IS TO MEET ITS CURRENT COMMITMENTS, GOVERNMENT PROCUREMENT OF A DIVERSIFIED FLEET OF ELV's IS ABSOLUTELY ESSENTIAL. THE STRATEGY SHOULD ADDRESS THE LONG TERM OBJECTIVES OF: (1) ASSURING OUR ACCESS TO SPACE; AND (2) MAINTAINING THE INDUSTRIAL BASE NEEDED TO CONTINUE ASSURED ACCESS BEYOND THE NEAR-TERM. I EMPHASIZE THE WORD "CONTINUING" BECAUSE A "STOP-GAP" PROGRAM TO SIMPLY SOLVE OUR IMMEDIATE PROBLEM WILL NOT ADDRESS THE FUNDAMENTAL ISSUE, WHICH IS TO AVOID DISRUPTION TO OUR NATIONAL LAUNCH CAPABILITY IN THE FUTURE. I WOULD ALSO EMPHASIZE THE WORD "DIVERSE", BECAUSE IT IS CLEAR THAT THE WAY TO PROTECT OURSELVES AGAINST A RECURRENCE OF THIS SITUATION IS TO HAVE MULTIPLE CAPABILITIES WHERE THE COUNTRY IS NOT DEPENDENT ON ANY ONE SINGLE SYSTEM OR MANUFACTURER FOR ITS ENTIRE SPACE LAUNCH CAPABILITY. THE NATIONAL SPACE TRANSPORTATION SYSTEM AND ITS INFRASTRUCTURE MUST BE ROBUST.

THE ESSENCE OF THIS ROBUST LAUNCH VEHICLE FLEET IS THE DIVERSE INDUSTRIAL BASE THROUGH WHICH IT IS PROVIDED. IT SHOULD CONSIST OF THE SHUTTLE AND A VARIETY OF DIFFERENT ELV's AND MATRIXED ACROSS SEVERAL MANUFACTURERS. NASA AND THE DoD SHOULD MANAGE THE IMPLEMENTATION OF SUCH A PLAN, COORDINATING THE NATIONAL CAPABILITY WITH THE DEMAND AND MAINTAINING A PRACTICAL SURGE CAPACITY TO ASSURE ACCESS TO SPACE.

THIS PLAN SHOULD RECOGNIZE THE IMPORTANCE OF COMPLEMENTARY EXPENDABLE LAUNCH VEHICLES AS A SUPPLEMENT TO THE SHUTTLE's UNIQUE CAPABILITIES. THIS TOTAL STABLE OF VEHICLES SHOULD BE OFFERED THROUGH A SINGLE PRICING POLICY WHICH IS TRANSPARENT TO THE SPECIFIC LAUNCH VEHICLE SELECTED. SUCH A PLAN SHOULD ALLEVIATE LAUNCH SCHEDULE PRESSURES BY PROVIDING ALTERNATIVE MEANS FOR LAUNCH. IN ADDITION, THE NEW PRICE SHOULD BE TARGETED TO PROVIDE A BASIS FOR TRANSITION TO COMMERCIAL LAUNCH SERVICES SOON AFTER COMPLETION OF NASA'S OBLIGATIONS UNDER THE CURRENT MANIFEST OF LAUNCH CUSTOMERS.

IN CONJUNCTION WITH OUR ANALYSIS OF THE SHUTTLE MANIFEST, WE HAVE ASSESSED OUR OWN CAPABILITY TO HELP REPLACE LOST LAUNCH CAPABILITY. I AM PLEASED TO REPORT TO THE COMMITTEE THAT THE RESOURCES DO EXIST IN AT LEAST FOUR MAJOR AREAS WHICH WOULD ENABLE US, IF CALLED UPON, TO HELP MEET THE COUNTRY'S CRITICAL LAUNCH REQUIREMENTS. THOSE MAJOR AREAS ARE: (1) AN EXISTING INVENTORY OF LAUNCH VEHICLES; (2) AN EXISTING PRODUCTION LINE TO MANUFACTURE ADDITIONAL LAUNCH VEHICLES; (3) AN EXISTING GROUP OF OPERATIONAL LAUNCH COMPLEXES FROM WHICH TO FLY THE MISSIONS, AND; (4) AN EXISTING TEAM OF EXPERIENCED MANAGEMENT, TECHNICAL, AND LAUNCH SERVICES PERSONNEL TO STAFF A SUBSTANTIAL PROGRAM.

REGARDING THE FIRST OF THESE AREAS, EXISTING LAUNCH VEHICLES, THERE ARE CURRENTLY BOTH ATLAS AND ATLAS/CENTAUR's COMING OFF THE PRODUCTION LINE. THREE ATLAS/CENTAUR's ARE CURRENTLY PLANNED TO LAUNCH NAVY FLTSATCOM SATELLITES. TWO OF THOSE LAUNCHES ARE SCHEDULED FOR THIS YEAR AND ONE FOR NEXT YEAR. IN ADDITION, THERE REMAINS ONE ATLAS-H VEHICLE WHICH IS READY FOR LAUNCH AND TWELVE ATLAS-E's TO BE REFURBISHED FOR LAUNCH FROM VANDENBERG AIR FORCE BASE.

SECONDLY, IN THE AREA OF PRODUCTION CAPABILITY, WE HAVE THE ONLY EXISTING OPERATIONAL PRODUCTION LINE TO PRODUCE ADDITIONAL MEDIUM SIZE LAUNCH VEHICLES IN THE COUNTRY. IT IS OUR BELIEF WE

HAVE THE CURRENT CAPACITY TO BUILD THREE ATLAS OR ATLAS/CENTAUR's IN 1988, AND FIVE EACH IN THE YEARS 1989 THROUGH 1992. SOME ADDITIONAL INVESTMENT IN RATE TOOLING AND FACILITIES COULD RELIEVE MANUFACTURING AND LAUNCH OPERATIONS CHOKE POINTS, AND LEAD TO PRODUCTION OF THREE ATLAS OR ATLAS/CENTAUR's IN 1988, NINE IN 1989 AND 17 PER YEAR BEGINNING IN 1990. THE MOST CRITICAL SPARE ASSET FOR MAKING THAT LAUNCH, AS WELL AS THE MOST TIME-SENSITIVE, LONG-LEAD ITEM WE MUST PROCURE, IS ROCKETDYNE MA-5 ENGINES. OUR NORMAL PRODUCTION LEADTIME TO LAUNCH OF AN ATLAS/CENTAUR IS 30 MONTHS. WE HAVE BEGUN EARLY MANUFACTURING PLANNING IN CONJUNCTION WITH ROCKETDYNE TO ASSURE THIS SCHEDULE WILL BE ATTAINED. WITH ADDITIONAL CAPITAL INVESTMENT, ATLAS PRODUCTION RATE IS NOT A CONSTRAINT (RATES IN EXCESS OF OVER 100 PER YEAR HAVE BEEN ACHIEVED IN THE PAST). ABOVE 15 LAUNCHES PER YEAR, PAD FACILITIES BECOME THE CONSTRAINT.

FUTURE PRODUCTION OF THE CENTAUR UPPER-STAGE VEHICLE CAN ALSO BE ACCELERATED BY THE ADDITION OF MORE FACILITIES, THUS EXPEDITING PRODUCTION OF TITAN/CENTAUR, ATLAS/CENTAUR, AS WELL AS THE SHUTTLE/CENTAUR. OUR TOTAL CURRENT PRODUCTION AND LAUNCH CAPACITY FOR CENTAUR IS TWO IN 1986, FOUR IN 1987, THREE IN 1988 AND FIVE FROM 1989 ON. ADDITIONAL TOOLING WOULD INCREASE OUR LAUNCH AVAILABILITY FROM THREE TO FIVE IN 1988, FIVE TO TEN IN 1989 AND FIVE TO SIXTEEN BEYOND 1990.

THE THIRD AREA WHERE SUBSTANTIAL EXISTING ASSETS CAN BE DRAWN UPON IS IN LAUNCH SITES. LAUNCH FACILITIES ARE IN EXISTENCE WHICH WILL SUPPORT INCREASED ELV ACTIVITIES, AND OTHER FACILITIES EXIST WHICH COULD BE REACTIVATED TO MEET ALL THE NECESSARY REQUIREMENTS IN ACCOMMODATING THE DISPLACED SHUTTLE PAYLOADS. THREE EXISTING LAUNCH SITES, TWO AT VANDENBERG AIR FORCE BASE AND ONE AT CAPE CANAVERAL, CURRENTLY SUPPORT ATLAS AND ATLAS/CENTAUR LAUNCHES. TWO OTHER COMPLEXES AT THE CAPE COULD BE REACTIVATED. THESE ARE LAUNCH COMPLEX 36A AND LAUNCH COMPLEX 13, BOTH OF WHICH WOULD SUPPORT ATLAS AND ATLAS-G/CENTAUR. COMPLEX 36A IS CURRENTLY USED FOR

SHUTTLE/CENTAUR TESTING, BUT THIS OPERATION COULD BE MOVED TO ANOTHER LOCATION. LAUNCH COMPLEX 13 COULD BE REFURBISHED AND REACTIVATED FOR ATLAS AND/OR ATLAS-G/CENTAUR LAUNCHES. ONE LAUNCH PAD AT VANDENBERG AIR FORCE BASE IS SCHEDULED THROUGH THE EARLY 1990'S TO ACCOMMODATE THE REMAINING TWELVE ATLAS-E LAUNCHES. THE OTHER LAUNCH PAD AT VANDENBERG AIR FORCE BASE HAS ONLY ONE REMAINING MISSION SCHEDULED AND COULD BE AVAILABLE FOR ADDITIONAL POLAR ORBITAL MISSIONS FOR DoD AND CIVILIAN LAUNCHES. BOTH PADS COULD ALSO BE UTILIZED FOR SDI TESTING.

THE FOURTH AND FINAL RESOURCE WHICH WE HAVE ON HAND TODAY IS PERHAPS THE MOST IMPORTANT OF ALL, AND THAT IS THE EXISTENCE OF THE TEAM OF DEDICATED AND EXPERIENCED MANAGEMENT AND TECHNICAL PERSONNEL WHO HAVE MADE THE ATLAS FAMILY OF LAUNCH VEHICLES ONE OF THE MOST SUCCESSFUL SPACE PROGRAMS IN THE WORLD OVER A QUARTER OF A CENTURY. TO DATE 486 ATLAS's HAVE FLOWN. THESE MISSIONS HAVE INCLUDED MANNED, SCIENTIFIC, PLANETARY, METEOROLOGICAL, NAVSTAR, GPS AND COMMERCIAL COMMUNICATIONS SATELLITES.

THE PURPOSE OF A MULTI-LAUNCH VEHICLE APPROACH IS TO MAKE THE SPACE SHUTTLE MORE AVAILABLE FOR NATIONAL PRIORITY MISSIONS WHILE PROVIDING RELIABLE U.S. LAUNCH CAPACITY FOR A DIVERSE USER COMMUNITY. WE BELIEVE THAT UNTIL THE SHUTTLE MANIFEST OVERFLOW SUBSIDES, THE SHUTTLE PROGRAM WILL MOST LIKELY EMPHASIZE SHUTTLE-UNIQUE PAYLOADS. WE BELIEVE THE SPACE SHUTTLE IS A MAGNIFICENT FLYING MACHINE. WE REGRET, AS DO ALL AMERICANS, THE CHALLENGER TRAGEDY AND THE LOSS OF THE SEVEN BRAVE AND DEDICATED CREW MEMBERS. WE DO, HOWEVER, TRUST THAT THE SPACE SHUTTLE WILL SOON FLY AGAIN AND BE A GREAT SOURCE OF NATIONAL PRIDE. WE BELIEVE THE SHUTTLE CAPACITY SHOULD BE REPLENISHED. THE SHUTTLE REPRESENTS THE NATION'S ACCESS TO A FUTURE IN SPACE. THE NEXT GENERATION OF SPACE EXPLORATION, THE SPACE STATION, SDI AND THE PROGRAMS WHICH ARE TO FOLLOW CAN ONLY BE MADE POSSIBLE THROUGH THE EXISTENCE OF A PRACTICAL SHUTTLE FLEET TO PROVIDE MANNED ACCESS TO NEAR-EARTH SPACE AND SOMEDAY TO THE PLANETS.

WE ARE HERE TO CONVEY THAT ELV CAPABILITY EXISTS TO ALLEVIATE THE PORTION OF SHUTTLE OVERFLOW - BOTH NEAR TERM AND LONG TERM - WHICH IS NOT SHUTTLE-UNIQUE IN NATURE. THE ATLAS AND ATLAS/CENTAUR FAMILY OF VEHICLES CAN ACCOMMODATE THE MAJORITY OF COMMUNICATIONS SATELLITES AT SIGNIFICANT LAUNCH RATES TO MAKE THE SPACE SHUTTLE AVAILABLE FOR NATIONAL PRIORITY PROGRAMS. WITH MODEST IMPROVEMENTS THE ATLAS/CENTAUR CAN PROVIDE LAUNCH SERVICES FOR ADDITIONAL PAYLOADS WHICH PREVIOUSLY HAD ONLY SHUTTLE OR ARIANE FROM WHICH TO CHOOSE.

IN THAT REGARD, MR. CHAIRMAN, I WOULD RECOMMEND THAT WE RECONSTITUTE THE NATION's SPACE LAUNCH CAPABILITIES TO ENSURE A ROBUST SYSTEM CONSTITUTED OF THE SHUTTLE AND SELECTED EXPENDABLE LAUNCH VEHICLES WITH A CORRESPONDING INDUSTRIAL BASE IN ORDER TO SUPPORT OUR COUNTRY's NEEDS. THE OVERALL OBJECTIVES OF OUR SPACE PROGRAM DEPEND UPON OUR ABILITY TO CONDUCT SPACE LAUNCHES.

THANK YOU FOR AFFORDING ME THIS OPPORTUNITY TO EXPRESS MY VIEWS AND I WILL BE HAPPY TO ANSWER ANY QUESTIONS THIS COMMITTEE MAY WISH TO POSE IN THIS REGARD.

Mr. Nelson. Thank you, Dr. Lovelace. Mr. Slayton.

Mr. Slayton. Mr. Chairman, members of the committee, we also appreciate the opportunity to be before you today and discuss some possible solutions to the loss of the shuttle *Challenger*.

We are comparatively small compared to the Atlas and some other vehicles you are familiar with, but we can generate a very high launch rate with a small vehicle, and there may be applications where small loads are preferable to large, especially into orbits that are nonstandard for the shuttle.

Since many of you don't have the familiarity with the *Conestoga*, which is our little vehicle, that you do with bigger vehicles developed under Government auspices, I would like to spend a little bit of time just explaining what our vehicle is because some of you may not really know.

No. 1, we think we have some unique attributes. We use totally commercially available hardware, for one thing, and that cuts our procurement cycle to a minimum.

Our motor base is based on a set of rockets that have a large number of firings behind them; the Castors have 1,600, the STAR's plus 1,400. We think that gives us a good baseline of reliability to work from.

We have a modular vehicle that we can scale up or down depending upon what the requirement is, and keep our costs down.

An inexpensive launch complex that is mobile. We are presently looking at six different launch sites, and are in various stages of progress negotiating for those.

Our maximum lead time to any first flight is 20 months, and we can reduce this dramatically by multiple procurements.

Our turnaround between flights on one pad is 2 weeks. With the existing production base on first stage and second stage motors, which we think is the long pole, with some minimum warehouse modifications, we can build a launch rate of 170 a year, which we think is probably adequate for near term, at least.

Through these principles we think we can provide a pretty cost-effective operation.

Charlie Chafer is going to help me here for a couple of minutes. I am going to use Dr. Lovelace's good training in how to use vugraphs here just to help explain it a little bit.

[Chart.]

Mr. Slayton. Our vehicle, the first stage is on the right, and that is the way we launch two Castor motors, burn for about 60 seconds. They are then dumped and you end up with the second vehicle, which is one Castor—that burns for another 60 seconds, and that is then jettisoned. We are left with then two STAR's for a third and a fourth stage, and the fourth stage is a STAR 30 or a 20 and goes into orbit with the payload.

[Chart.]

Mr. Slayton. The next chart shows the launch projectory, and there is nothing magic about that. We can go into a large variety of orbits any inclination. We can range from 3,000 down to 300 pounds depending upon where you want to go.

[Chart.]

Mr. Slayton. The next one shows our vehicle configurations, how we scale up and down. Our core vehicle is on the left, and that was designed to match our own payload for an Earth-sensing satellite—945 pounds into polar orbit.

We add additional motors on to add onto that performance by—double it, actually, on the right—or we can scale down by dropping a couple of motors off to a third of that. So we have got a large variety of capacity there, depending on what the customer wants.

[Chart.]

Mr. SLAYTON. This just shows the relative performance between them and the scale—the one on the bottom is equivalent to a Scout, which many of you are familiar with; so we basically have got six times the Scout with the big vehicle, just to put things into context.

[Chart.]

Mr. SLAYTON. The launch site—I have got another chart that shows how we compare with the other vehicles, which might help also.

You see where less than half of capability of a DELTA. We do have the Atlas/Centaur rough on the right, so you can see we are relatively small and, therefore, specialized.

[Chart.]

Mr. SLAYTON. The next one is our launch site complex. The idea we have here is to use primarily portable materials, trailers—there is only one piece of fixed gear and that is the launch pad and the gantry. By following this concept, we can put together a very cheap launch site very fast—about 6 months. We started in with the idea we wanted to be able to launch from anywhere in the world. That is probably not necessary to support the NASA missions, but it very well might be for some others. Again, we were trying to address the customers' desires.

[Chart.]

Mr. SLAYTON. The launch pad—we would haul the motors directly to the pad and erect them, which deletes the requirement for a big permanent building in the launch area.

We do a stacking similar to the shuttle and the Titans, which again, is straightforward, well understood technology.

The next one, Charlie.

[Chart.]

Mr. SLAYTON. This is our only piece of permanent equipment on the launch pad and, again, that can be removed if it doesn't have a requirement—it is a fold-down gantry.

So that, in essence, is our hardware.

Our costs are based on the concept of a fixed price to match a performance spec versus a cost-plus. I think the difference between those needs to be clearly understood. The way we operate is we do not have multiple layers of management, inspection, reviews, et cetera, in our commercially based system. Our prices are priced accordingly. If we have to price to match the standard Government way of doing business, our prices will not be the same.

We also offer a turnkey operation which means the price we offer delivers a payload on orbit—it doesn't include any other hidden costs.

Another aspect of our cost picture is that there may be a small is beautiful syndrome here, primarily looking at the problems with insurance these days, and multiple payloads, large payloads, and the difficulty of insuring them, and the financing that goes with that problem.

Increase of the expensive satellites launch of multiples may have already exceeded the capacity of the commercial insurance; and I think you have had some testimony along those lines in this committee by some other people.

So we think that maybe the insurance problem by itself may drive a lot of merit towards launching things in smaller units and toward a smaller vehicle.

We are definitely not competitive with shuttle, placing things into a shuttle-type orbit. We are very competitive in placing small payloads into non-shuttle-type orbits. Just as a baseline, we have a little Space America type Earth remote sensing satellite which we could launch into the orbit required for half the cost on a shuttle. You have to understand what goes into that and that relates to the requirement for a Vandenberg launch into a nonstandard orbit. And for those kind of orbits we are cost effective.

We believe that you can find a reasonable solution to the current shuttle problem by following this procedure—and I think this is basically what Dr. Lovelace has said and some other people ahead of me.

Screen all of the existing payloads against three criteria:

No. 1, is there a manned interface required?

No. 2, is the payload recovery necessary?

No. 3, is the shuttle the only launcher available with adequate lift capacity?

Obviously, if the answer to those is yes, the shuttle is the only vehicle that can accomplish it.

If the answer is no, then as a starting point, I would delete those payloads off the shuttle manifest. Try to re-manifest the remaining known and projected payloads into the available fleet.

If they don't fit, and with a reasonable reserve, then you have no options, in my opinion; you have to commit to building a new shuttle—one or more, and again, how those numbers come out will define that number.

If they do fit, you then have the option of committing those resources to development of a potential follow-on vehicle, which you may or may not choose to exercise. But at least it gives you some opportunities. There is a different solution to the problem.

In direct answer to one of your questions, do we believe the Government should buy launch services from commercially available sources to accommodate payloads which don't require the shuttle's capabilities—our answer obviously is yes. There should be a direct cost savings from sharing the cost base with the commercial market and the advantage of taking a short lead and a fast schedule available commercially.

Indirect benefits accrue to the U.S. economy through fostering new companies, gets an increase in the GNP, and improves the tax base and improves our competitive posture internationally. And there are a lot of other motherhood statements that go along with that.

We are standing by to expeditiouly and economically support whatever requirements fit our capabilities. We don't know that there are any at the present time, but at least you understand what we are capable of doing.

Thank you.

[The prepared statement of Mr. Slayton follows:]

Statement of Donald K. (Deke) Slayton
President, Space Services Inc. of America (SSI)
Before the Subcommittee on Space Science and Applications
March 6, 1986

Chairman Nelson, members of the Subcommittee, we appreciate the opportunity to appear before you and express our views on possible solutions to the problems posed by the loss of the space shuttle, Challenger. Although we are relatively small in single launch payload size compared to others testifying here today, we can generate a very high launch rate. There may be applications where many small loads are preferable to one large, especially into orbits nonstandard for shuttle. Since many of you may not have the familiarity with Conestoga you do with vehicles developed under government auspices, allow me to spend some of my time explaining our capabilities. We offer the following unique attributes:

- Use of commercially available hardware insures supply will meet demand in the most economical mode. Lengthy, expensive procurement procedures are avoided.

- A large successful experience base on our motors -- 1600+ Castor firings and 1400+ STAR firings -- insures high reliability.

- Modular use of hardware allows matching Conestoga to a broad range of requirements at minimum cost.

- An inexpensive mobile launch complex allows operations from multiple optimized launch sites economically. We have negotiations for six different sites in various stages of progress.

- Our maximum lead time to any first flight is 20 months. This can be reduced dramatically in later flights by early commitments to multiple flights.

- Our turnaround time between flights on one pad is two weeks. We can attain a launch rate of approximately 170 flights per year with minimum modification of production facilities and by adding launch pads as required.

- We achieve cost effective operations through application of the above listed principles.

Our core vehicle, the Conestoga II, is a point design to match the performance requirements for our own earth remote sensing spacecraft. This is 945 lbs into a 500 N.M. sun synchronous (99.1 degree inclination) orbit. It consists of two Castor IV's for first stage, one for second stage, a STAR 48 for third stage, and STAR 30 for fourth stage. The total configuration of each stage is shown in Figure 1 and the launch profile in Figure 2. This basic vehicle can be expanded or contracted (Figure 3) to cover a variety of payload requirements with minimum nonrecurring costs. Integration, which is relatively straightforward, is the only variable. Relative performance of the Conestoga family into a basic sun synchronous earth remote sensing orbit varies from 300 lbs to 1900 lbs (Figure 4). Performance relative to other available ELV's is five times Scout, one-half Delta, or one-fourth Ariane (Figure 5).

The launch site configuration is based on the concept of portability and economy (Figure 6). We targeted to be able to launch from anywhere in the world, dependent upon nationalistic interests of customers, on very short notice. Motors are delivered directly to the launch pad and erected on site (Figure 7). Stacking is similar to shuttle but is done on the pad eliminating requirements for large sophisticated vehicle assembly buildings (Figure 8). The missile service tower is used in assembly and check out (Figure 9), and is one of the few semipermanent fixtures on each launch complex. These are also transferable to new sites should an old site be abandoned. We don't need to build expensive steel monuments a la Cape Canaveral.

Our costs are based on the concept of fixed price to match a performance specification versus cost plus relative to a design specification. An understanding of the difference is critical to creating a true commercial market. One cannot apply multiple layers of management, inspection, and reviews with associated overhead costs and maintain a viable commercial system. Obviously we are prepared to support government customers in the fashion to which they are accustomed, but the price goes up accordingly.

We also offer a turnkey operation which means in everyday parlance our price quote puts you on orbit with no hidden costs or add-ons required to get airborne.

Another aspect of cost is that small may be beautiful from an insurability point of view. Increasingly expensive satellites launched in multiples have exceeded the capacity of the commercial insurance industry. Although the concept of bigger is better is widely embedded in our economy, we may have reached the point in space operations where insurance costs tip the balance in favor of spreading risks across multiple small units.

We are not competitive with shuttle prices into shuttle standard orbits. We are very competitive when placing small payloads into nonstandard high circular, sun synchronous, or molniya orbits. As a reference point, launch of our Space America earth remote sensing satellite would cost twice as much on shuttle as on Conestoga. However, shuttle has the unique capabilities of being manned and recoverable which are mandatory to many important applications. This is a national resource that should not be squandered on payloads not requiring these capabilities. A business based on a payload with real commercial value should proliferate even though launch costs may exceed current shuttle pricing standards. For example, it has been proposed that insurance costs approaching the value of the airborne element would still allow a viable telecommunications industry since major systems costs are in the ground elements. If true, there should also be considerable latitude in the definition of acceptable launch costs.

We believe a reasonable solution to the current limit on shuttle capacity could be reached by the following process:

1. Screen all payloads against the following criteria:

    a. Is a manned interface necessary?
    b. Is payload recovery necessary?
    c. Is the shuttle the only launcher available with adequate lift capacity?

2. If the answer to all the above is "no," delete that payload from the current shuttle manifest.

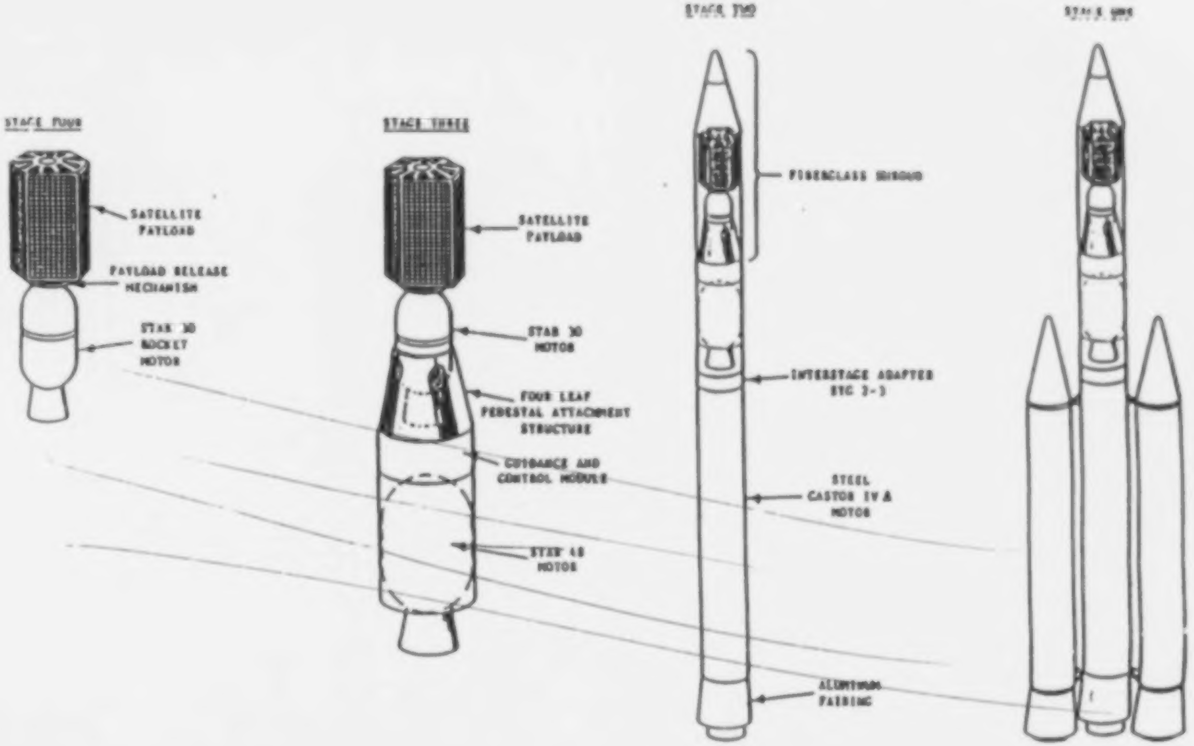
3. Try to remanifest the remaining known and projected payloads into the available fleet.

4. If they don't fit, including a reasonable management reserve, commit to one or more new shuttles immediately.

5. If they do fit, commit the resources people are now willing to spend on more shuttles towards development of the shuttle follow-on vehicle.

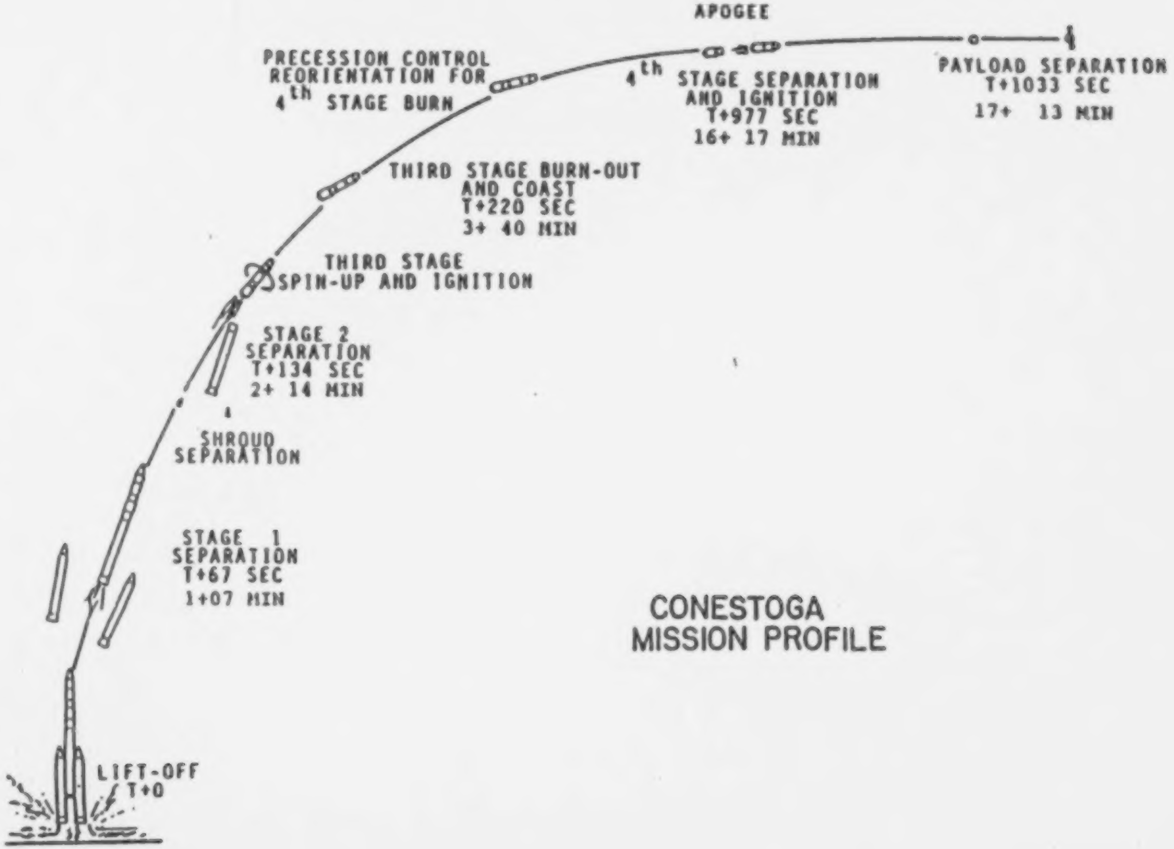
In direct answer to one of your questions, we believe the government should buy launch services from commercially available sources to accommodate payloads which don't require the shuttle's unique capabilities rather than procure and operate their own system. There should be direct cost savings from sharing cost base with the commercial market and taking advantage of the short lead and fast schedule available commercially. Indirect benefits accrue to the U.S. economy through fostering growth of new companies with associated increase in GNP and improved U.S. competitive posture in the international marketplace.

We are standing by to expeditiously and economically support whatever requirements fit our capabilities . Thank you.


STAGE FOUR
SATELLITE PAYLOAD
PAYLOAD RELEASE MECHANISM
STAR 30 ROCKET MOTOR
STAGE THREE
SATELLITE PAYLOAD
STAR 30 MOTOR
FOUR LEAF PEDESTAL ATTACHMENT STRUCTURE
GUIDANCE AND CONTROL MODULE
STAR 48 MOTOR
STAGE TWO
FIBERGLASS SHROUD
INTERSTAGE ADAPTER STG 2-3
STEEL CASTOR IV A MOTOR
ALUMINUM FAIRING
STAGE ONE

CONESTOGA IIA LAUNCH VEHICLE STRUCTURAL CONFIGURATION

Figure 1


APOGEE
PRECESSION CONTROL
REORIENTATION FOR
4th STAGE BURN
4th STAGE SEPARATION
AND IGNITION
T+977 SEC
16+ 17 MIN
PAYLOAD SEPARATION
T+1033 SEC
17+ 13 MIN
THIRD STAGE BURN-OUT
AND COAST
T+220 SEC
3+ 40 MIN
THIRD STAGE
SPIN-UP AND IGNITION
STAGE 2
SEPARATION
T+134 SEC
2+ 14 MIN
SHROUD
SEPARATION
STAGE 1
SEPARATION
T+67 SEC
1+07 MIN
LIFT-OFF
T+0

CONESTOGA
MISSION PROFILE

Figure 2

Conestoga Vehicle Evolution

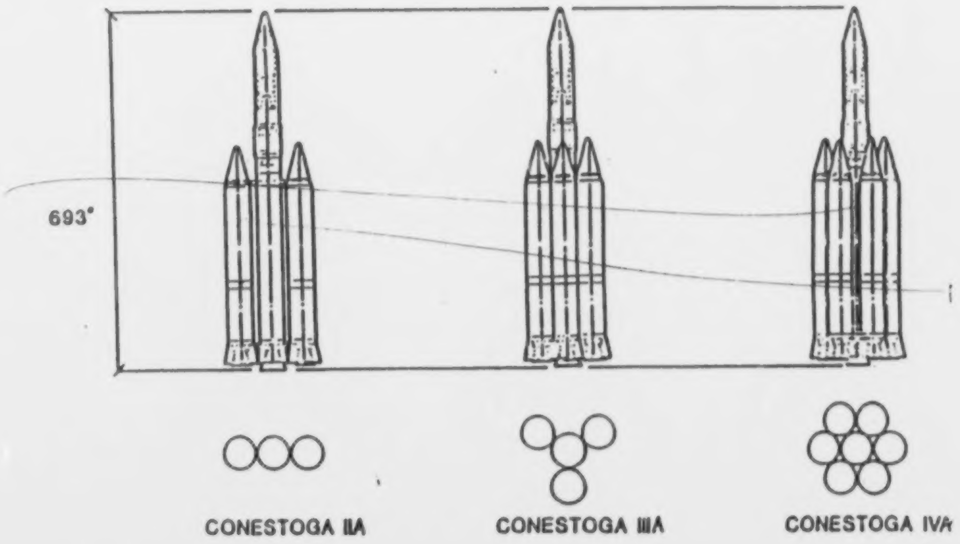

693"
CONESTOGA IIA
CONESTOGA IIIA
CONESTOGA IVA

Figure 3

Conestoga
Sun Synchronous Performance Capability

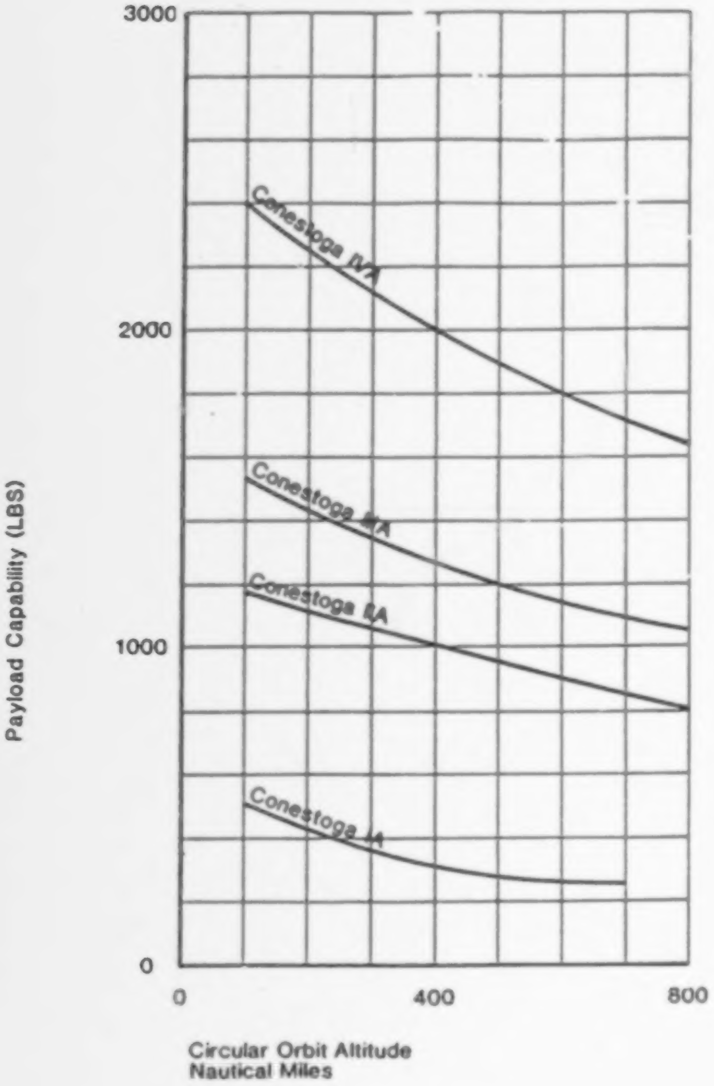


Figure 4

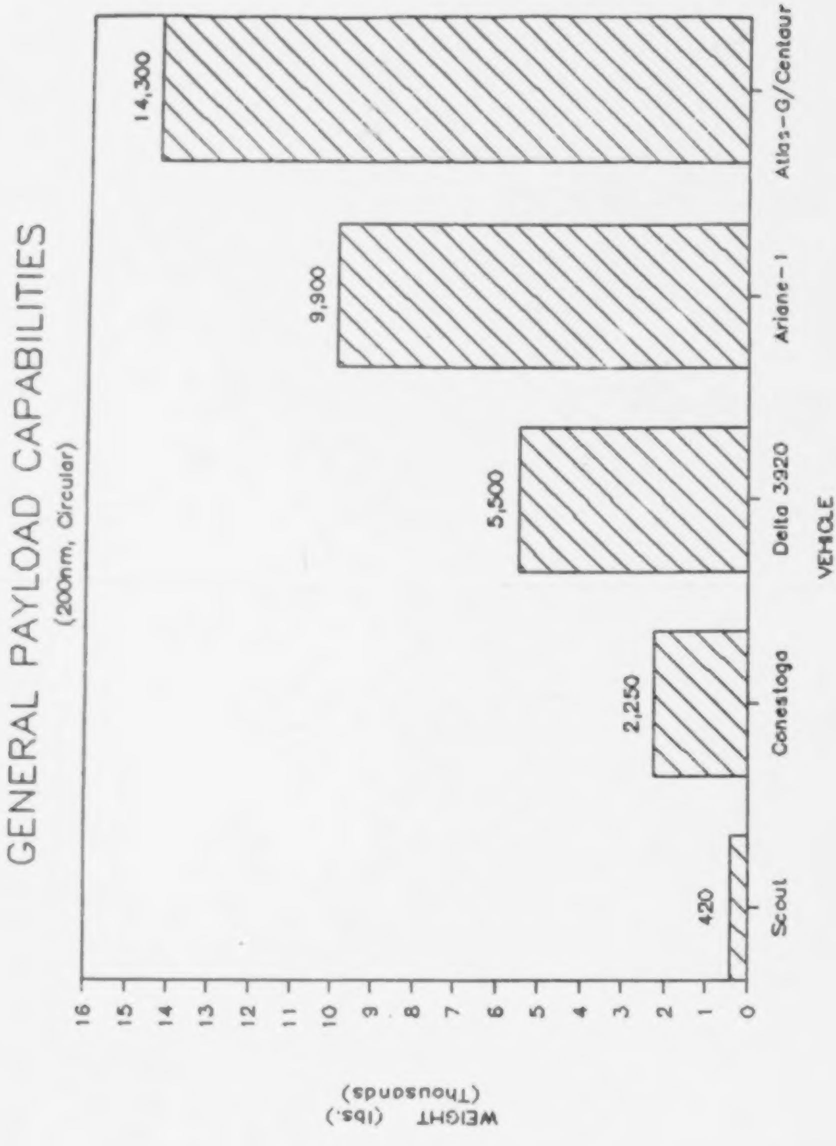

GENERAL PAYLOAD CAPABILITIES
(200nm, Circular)
WEIGHT (lbs.)
(Thousands)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
420
2,250
5,500
9,900
14,300
Scout
Conestoga
Delta 3920
Ariane-1
Atlas-G/Centaur
VEHICLE

Figure 5

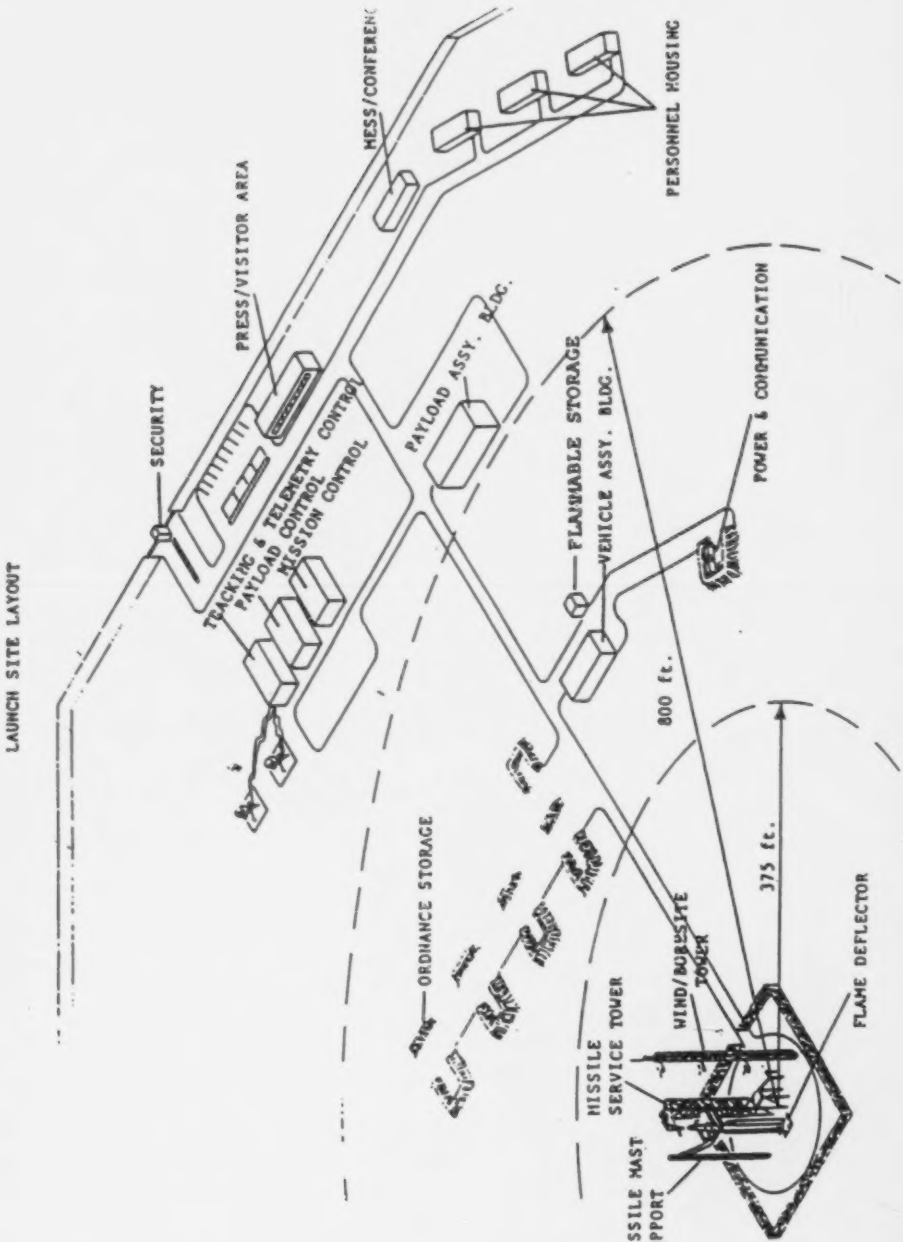

LAUNCH SITE LAYOUT
SECURITY
PRESS/VISITOR AREA
MESS/CONFERENC
PERSONNEL HOUSING
TRACKING & TELEMETRY CONTROL
PAYLOAD CONTROL
MISSION CONTROL
PAYLOAD ASSY. BLDG.
FLAMMABLE STORAGE
VEHICLE ASSY. BLDG.
POWER & COMMUNICATION
ORDNANCE STORAGE
800 ft.
375 ft.
MISSILE SERVICE TOWER
WIND/BORESITE TOWER
FLAME DEFLECTOR
MISSILE MAST SUPPORT

Figure 6

BOOSTER ERECTION

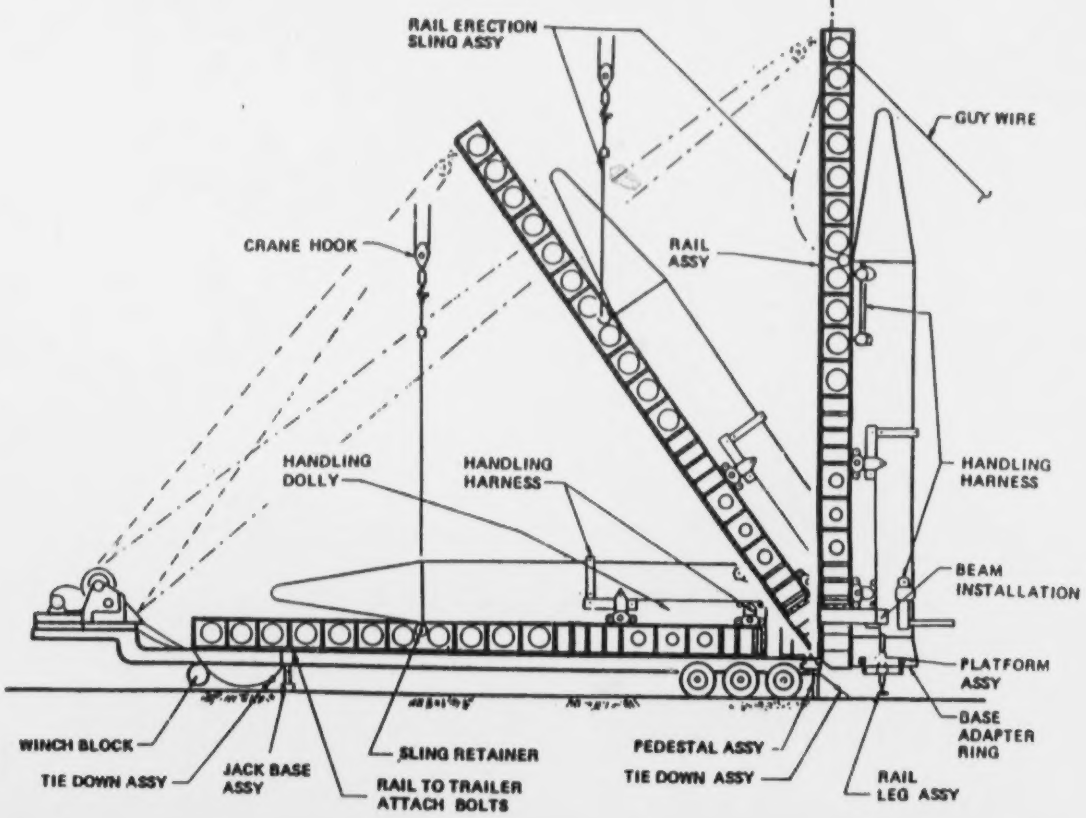
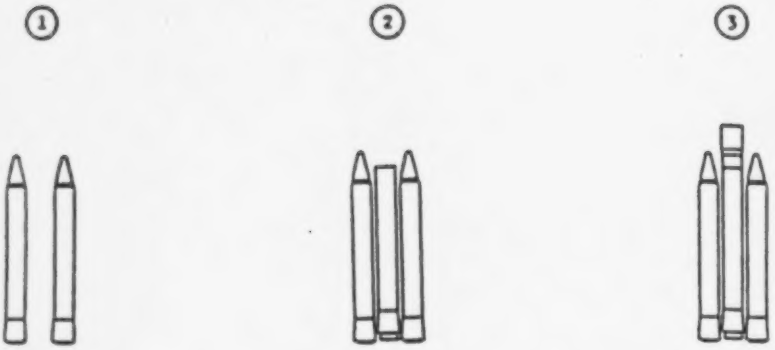

RAIL ERECTION SLING ASSY
GUY WIRE
CRANE HOOK
RAIL ASSY
HANDLING DOLLY
HANDLING HARNESS
HANDLING HARNESS
BEAM INSTALLATION
PLATFORM ASSY
BASE ADAPTER RING
WINCH BLOCK
TIE DOWN ASSY
JACK BASE ASSY
RAIL TO TRAILER ATTACH BOLTS
SLING RETAINER
PEDESTAL ASSY
TIE DOWN ASSY
RAIL LEG ASSY

Figure 7

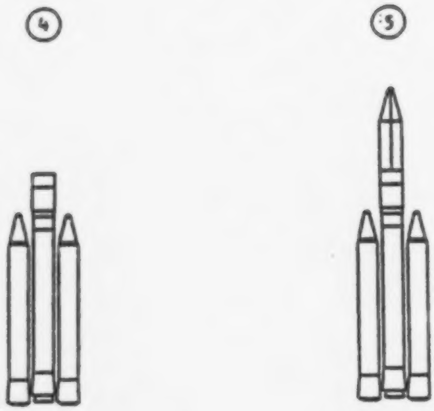


CORE PEDESTAL INSTALLATION

STAGE 1 STACKING

STAGE 2 INSTALLATION

STAGE 3 INSTALLATION



INTERSTAGE AND ATTITUDE CONTROL MODULE INSTALLATION

STAGE 4, PAYLOAD AND SHROUD INSTALLATION

INTEGRATION AND VEHICLE TEST

CONESTOGA IIA VEHICLE ASSEMBLY OPERATIONS

Figure 8

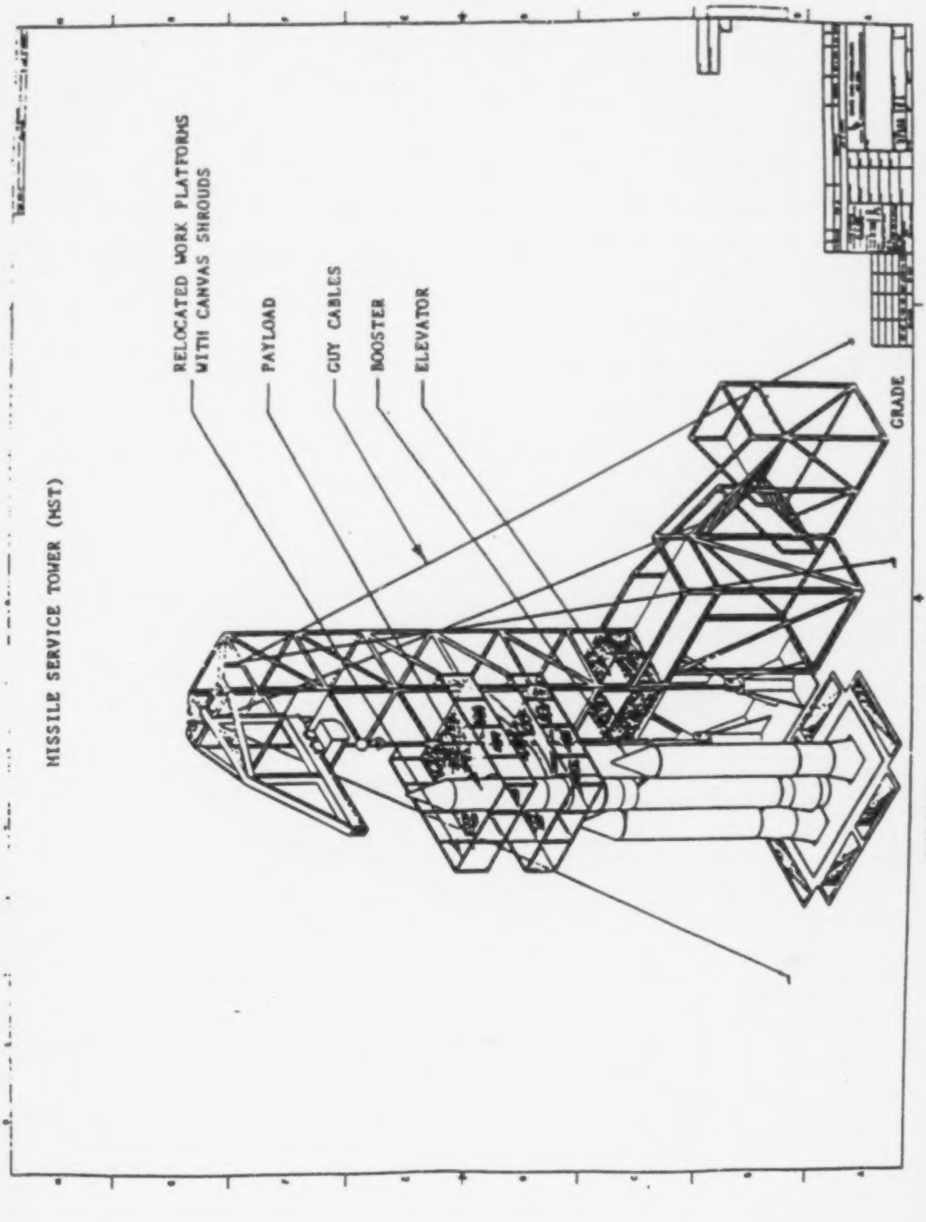

MISSILE SERVICE TOWER (MST)
RELOCATED WORK PLATFORMS WITH CANVAS SHROUDS
PAYLOAD
GUY CABLES
BOOSTER
ELEVATOR
GRADE
MODIFIED SERVICE TOWER

Figure 9

DONALD K. SLAYTON

BIRTHPLACE & DATE: Sparta, Wisconsin on March 1, 1924

PHYSICAL DESCRIPTION: Gray hair; blue eyes; 5'10 1/2"; 165 lbs.

MARITAL STATUS: 1983, Married to the former Bobbie Osborn of Dickinson, Texas

CHILDREN: Kent, April 8, 1957

EDUCATION: Graduated from Sparta High School in Sparta, Wisconsin; Bachelor of Science degree in Aeronautical Engineering from the University of Minnesota, Minneapolis, Minnesota in 1949; honorary doctorate in Science from Carthage College, Carthage, Illinois in 1961; honorary degree in Engineering from Michigan Technological University in Houghton, Michigan in 1965.

RECREATIONAL INTERESTS: Hunting, fishing, shooting, airplane racing

ORGANIZATIONS: Fellow of the Society of Experimental Test Pilots, the American Astronautical Society, and the American Institute of Aeronautics and Astronautics; member of the Experimental Aircraft Association, the Space Pioneers, the International Formula Pylon Air Racers, and the National Air Racing Group; life member of the Order of Daedalians, the National Rifle Association of America, the Veterans of Foreign Wars, and the Fraternal Order of Eagles; and honorary member of the American Fighter Aces Association, and the National WWII Glider Pilots Association.

SPECIAL HONORS: Awarded four NASA Distinguished Service Medals, two NASA Outstanding Leadership Medals, and a NASA Exceptional Service Medad; the Collier Trophy; the SETP Iven C. Kincheloe Award; the General Billy Mitchell Award; the SETP J. H. Doolittle Award for 1972; the National Institute of Social Science's Gold Medal in 1976; the Zeta Beta Tau's Award Richard Gottheil Medal in 1975; the Wright Brothers International Manned Space Flight Award in 1975; the Veterans of Foreign Wars National Space Award in 1976; the Federation Aeronautique Internationale's Yuri Gargarian Gold Medal in 1976; the American Heart Association's Heart of the Year Award in 1976; the University of Minnesota's Outstanding Achievement Award in 1977; the Houston Area Federal Business Association's Civil Servant of the Year Award in 1977; the AAS Flight Achievement Award for 1978.

DONALD K. SLAYTON

MILITARY EXPERIENCE: Entered the Air Force in April 1942 as an aviation cadet and received wings in April 1943 after completing flight training at Vernon and Waco, Texas. Flew 56 combat missions in Europe as a B-25 pilot with the 340th Bombardment Group. Returned to the United Stated in mid-1944 and served as a B-25 and A-26 instructor pilot at Columbia, South Carolina. In April 1945, was sent to Okinawa with the 319th Bombardment Group and flew 7 combat missions over Japan in A-26s. Served as a B-25 instructor for one year following the end of the war and left the Air Force to enter the University of Minnesota. Became an aeronautical engineer after graduation and worked for 2 years with the Boeing Aircraft Corporation at Seattle, Washington, before being recalled to active duty in 1951 with the Minnesota Air National Guard.

Assigned as maintenance flight test officer of an F-51 squadron located in Minneapolis, followed by 18 months as a technical inspector at Headquarters Twelfth Air Force, Weisbaden, Germany, and a similar tour as fighter pilot and maintenance officer with the 36th Fighter Day Wing at Bitburg, Germany. Returning to the United States in May 1955, attended the USAF Test Pilot School at Edwards Air Force Base, California. Was an experimental fighter test pinot there until April 1959 conducting flight tests of fighter aircraft built for the United States and some foreign countries.

Logged more than 8,000 hours flying time, including 5,000 hours in jet aircraft.

NASA EXPERIENCE: Named as one of the Mercury astronauts in April 1959. Originally scheduled to pilot the Mercury-Atlas missions but was relieved of this assignment due to a heart anomoly discovered in August 1959. The MA-7 mission was subsequently flown by M. Scott Carpenter in May 1962.

Became the first Chief, Astronaut Office in September 1962 and was responsible for the management of the astronaut office. In November 1963, resigned commission as an Air Force Major to assume the role of Director of Flight Crew Operations. In this capacity, was responsible for directing the activities of the astronaut office, the aircraft operations office, the flight crew integration division, the crew training and simulation division, and the crew procedures division. Was restored to full flight status in March 1972, following a comprehensive review of medical status by NASA's Director of Life Sciences and the Federal Aviation Agency.

Apollo Docking Module Pilot of the Apollo-Soyuz Test Project (ASTP) mission, July 15-24, 1975 -- a joint space flight culminating in the first historical meeting in space between American astronauts and Soviet cosmonauts. Completing the United States flight crew for this 9-day earth-orbital mission were Thomas P. Stafford and Vance D. Brand. In the Soviet spacecraft were cosmonauts Alexey Leonov and Valery Kubasov.

The crewmen of both nations participated in a rendezvous and subsequent docking, with Apollo the active spacecraft. The event marked the successful testing of a universal docking system and signaled a major advance in efforts to pave the way for the conduct of joint experiments and/or the exchange of mutual assistance in future international space explorations. There were 44 hours of docked joint activities during ASTP, highlighted by four crew transfers and the completion of a number of joint scientific experiments and engineering investigations. All major ASTP objectives were accomplished and included: testing a compatible rendevous systems in orbit; testing of androgynous docking assemblies; verifying techniques for crew transfers; and gaining experience in the conduct of joint international flights. Apollo splashed down in the Pacific Ocean near Hawaii and was quickly recovered by the USS New Orleans. Slayton logged 217 hours and 28 minutes in his first space flight.

As Manager of the Space Shuttle Approach and Landing Test from December 1975 through November 1977, Slayton directed the Space Shuttle through a series of critical Orbiter Flight Tests that allowed inflight test and checkout of flight controls and Orbiter subsystems and permitted extensive evaluations of the Orbiter's subsonic flying qualities and performance characteristics. These tests also verified capability to ferry Shuttle aboard the 747 which was used as launch vehicle.

From November 1977, until retiring March 1982, he served as Manager for Orbital Flight Test, directing orbital flight mission preparations and conducting missions operations. This included OFT operations scheduling, mission configuration control, preflight stack configuration control, conducting planning reviews, mission readiness reviews, and postflight mission evaluations.

CIVILIAN EXPERIENCE: Mission Director and Range Safety Officer for the successful private venture launch of the Conestoga I, September 9, 1982 from Matagorda, Island. Consultant to Aerospace Corporation. Elected President of Space Services in November 1982.

CURRENT ACTIVITIES: President and Vice Chairman, Space Services Incorporated of America; Chairman, Space America Incorporated; President, International Formula One Pylon Air Races; Member, Department of Transportation Commercial Space Advisory Committee; Consultant, Aerospace Corporations; Director, Columbia Astronautics.

Mr. NELSON. Thank you all.

May I invite those of you who are standing—there are plenty of seats over here. So unless you are trying to exercise your legs, you are welcome to come on across and have a seat.

Dr. Lovelace, tell me something about the pricing policy that you said—a single pricing policy.

Mr. LOVELACE. Let me see if I can outline for you the thought that we tried to convey in the statement, Mr. Nelson. My assumption is that we need to start immediately to try to alleviate the problem of the overflow of payloads that have resulted from the reduction in our shuttle capability. To do that, it seems to me the first thing that has to happen is the Government has got to step in and help to fill that gap with the industry, but the Government is probably going to have to take the initial lead. It is, I think, unreasonable to anticipate that the industry will be able to step up and will in fact make the upfront investments until it is clear what the national policies may be relative to the overall domestic competitive market.

So a method of getting into that world is for the Government to start and purchase some expendable launch vehicle services to take care of, in as a timely way as they can—because there is going to be a disruption in any event—take care of the needs of the commercial and the Government users, and then provide a transition plan by which the industry then can pick up and provide those services on a truly commercial basis. By that time, it would be my expectation that whatever policy changes or statements are going to be made relative to the role of the Government and the role of the private sector will have been clarified. And if they are such as to really encourage domestic commercial launch services then you can begin to see an increased investment by the private sector to sustain that into the outyears.

Mr. NELSON. Mr. Slayton, you talked about a multiple selection of launch sites—I think you said six. Are you at liberty to share any of that with us?

Mr. SLAYTON. Yes, sir. When we started trying to build a commercial business, we were not being encouraged to use the Government sites, so we immediately started searching for what was available commercially. The south point of Hawaii, the big island, looks most attractive initially because from an orbital mechanic's point of view we can go into any inclination from there, and it is a little closer to the Equator—pick up a better performance, so that appeared optimum.

We have negotiated—very close to signing an agreement with a couple of people there to build a launch site in that location.

We also have an island off the Mississippi coast. It is a privately owned island. We had an option to utilize—that was strictly for polar orbits.

About the timeframe we negotiated that was when the ELV bill was passed and we were encouraged to utilize Government ranges. At that point we started talking to both the Air Force at Vandenberg for polar launches and to NASA about the use of Wallops Island for easterly launches.

We are pursing the NASA-Wallops site first because that is our first known requirement. We have gotten good support from the

Air Force for using Vandenberg. We understand very well and they understand what we need to do to consummate that. We hope the Wallops agreement is virtually on the point of being signed. We have been jointly working a draft here for a year on it. We went over it with them last week, as a matter of fact, so we think we are pretty close in on that.

We have also looked at a couple of sites in the Virgin Islands, which would allow us to do easterly launches and also polar launches.

But our first thrust today is to try to do a satisfactory Government launch site. Now, when we get through and get the cost, which we have no idea what they are going to end up being, we may discover we can't afford it; in which case we would jump to a commercial site.

Mr. NELSON. You mentioned that there are times when small loads would be preferable to a large one. You said especially in orbits that would not be orbits that the shuttle could be in.

Can you give us a little more information there?

Mr. SLAYTON. Yes, sir. The first one that I alluded to with our own remote sensing, which is a small payload—it is about 1,000 pounds. When you start comparing cost per pound, you have to be very specific about where you want to go with it. But what happened to that payload—by the time we adapted it to the shuttle, put enough propellant on board to accommodate our launch window, which we have no control over since we are small, and put it into a higher orbit, which the shuttle doesn't go to—our 1,000-pound payload grew to 8,000 pounds. That is why the cost of that essentially doubled.

Now, the small payloads that I am talking about—there are a couple that we are looking at, three, as a matter of fact. But one of them was defined as small by the customer to us, and that is the human cremains, and they said we need 300 pounds. That is all they needed, they didn't want any more, and they didn't want to pay for any more.

We have also looked at the concept of disposing of toxic and atomic wastes. That has been studied for 10 years. It is still a major problem. We have been talking to a number of people about how do you concentrate this into a package that you could consider launching. There have been studies done that show that you can package it, have a launch accident, and have it recovered safely. So that is not an issue. It takes some engineering work. Again, that needs to be done in small packages. You don't want to do it in big packages. So those are just a couple of the things.

The low Earth orbit communications is another one that we are looking at. These are primarily the highly elliptic orbits that the Russians originally initiated for northern latitudes, and we have a couple or three commercial applications for those kind of orbits. Again, those are small payloads going to an orbit that the shuttle never goes to.

Mr. NELSON. Do you have enough customers to launch 170 of these a year?

Mr. SLAYTON. No; we don't. We ran that number to support a study for SDI, which has some astronomical numbers related to an operational program. We said, well, we can do that many. If you want some more it will take a little extra money upfront to expand production.

Mr. NELSON. If you had 170 commercial launches a year you would become the People's Express of commercial space launches.

Mr. SLAYTON. That is correct. We will settle for about four right this minute. [Laughter]

Mr. NELSON. Let's get some of our members—Mr. Brown?

Mr. BROWN. No, thank you, Mr. Chairman.

Mr. NELSON. Mr. Barton.

Mr. BARTON. Thank you, Mr. Chairman.

I have several questions for both of you gentlemen.

Mr. Slayton, I am intrigued by your screen criteria on page 3 of your written testimony. It says,

> Screen all payloads against the following criteria:
> Is a manned interface necessary?
> Is payload recovery necessary?
> Is the shuttle the only launcher available with adequate lift capacity?

Have you done, or your company done, any analysis on c., to determine how many of the manifested payloads currently on the shuttle would actually have to go on the shuttle because of the lift capacity? Could you give us some information about that?

Mr. SLAYTON. We have not done that personally. I am aware of a couple three: the space telescope is one we know of; I think Galileo is another, and I am sure there are a number of others that fit that category. But we have not done an in-depth review of the shuttle payload manifest.

We have talked to NASA about our capabilities, so they know that we can handle the smaller end if there are anything. It is my opinion we are not going to find very many things that fit our capability. I think we will find a large number that fit Dr. Lovelace's capability.

Mr. BARTON. Dr. Lovelace, you go through a similar analysis and basically reach the conclusion that the only payloads that are going to be on the shuttle are those that have to be on the shuttle.

Could you tell me how many don't have to be, so to speak; the same question?

Mr. LOVELACE. Mr. Barton, let me see if I can tell you what we did do. No. 1, we didn't do a total U.S. launch requirements analysis. That goes much beyond what we did. What we did do was take the shuttle manifest as it is detailed out through 1989, and that is pretty much the horizon at which you begin to lose detail on what the payloads are. We took all the payloads in those manifests and we categorized them in roughly four categories: Three weight categories under 3,000, and then the 3,000 to 6,000, and then 6,000 and over, and then shuttle-unique. Shuttle-unique, by our definition, were payloads that we knew—such as the Hubble Telescope—could only be flown in the shuttle; and there were a number of Department of Defense payloads which we assumed were shuttle-only payloads and we just left them in that grouping of shuttle-unique.

Then assuming that we can get the current three orbiter fleet back operational at 14 a year, we simply started to add the payloads back in. We gave priority to the shuttle-unique payloads; we gave priority to the DOD payloads, more specifically to the Global Positioning satellites that are contained in that manifest; and then worked our way down to the remaining government payloads, to the commercial satellites. And I hope my colleagues in the communication industry will forgive me for having put them at the bottom of that priority list, but it was simply a matter of trying to get the sensitivity of it.

Anyone can now take this data and change those priorities, and adjust them as they fit. When one does that, as in our study, if the fleet is down for 12 months and comes back as a three orbiter fleet, operating 14 flights a year, shuttle flights a year—if I could give you one prime number to remember—there are going to be some 64 of the payloads in those other three weight classes that I mentioned that are going to be in a sense unaccounted for by having any identifiable launch vehicle to put them in orbit.

Mr. Barton. These 64 payloads, though, are not—if I understand you correctly—are not shuttle-unique. They could go on an expendable launch vehicle?

Mr. Lovelace. These are payloads that we believe, by our understanding, could be accommodated by an expendable launch vehicle. That isn't to say that they would not have to be reintegrated on this new launch vehicle because many of them are integrated—and right now have been doing their integration solely for the shuttle.

Mr. Barton. And these are existing payloads that were already scheduled to go on the shuttle; is that correct?

Mr. Lovelace. They are payloads—they are satellites that are contained in the shuttle manifests for the years 1986, 1987, 1988, and 1989.

Mr. Barton. If we decided to expand the expendable launch vehicle fleet—which I personally think we need to—between the capability at the high end in the Atlas and the capability at the low end in the Conestoga—and I am talking just in payload capacity, not in quality or anything like that—could we meet the existing requirements as you see them? I would like both of you to respond to that.

Mr. Lovelace. Let me respond to that first. I think that clearly that can be done. One of the conclusions of our study is there are existing, proven expendable launch vehicles which could satisfy that need. I have to add, however, in the case of some of the larger and medium size launch vehicles there is a leadtime of 2½ to 3 years in order to get new hardware manufactured, assembled, and to the pad, and launched.

Mr. Barton. OK.

Mr. Slayton, do you agree with that?

Mr. Slayton. Yes; I was looking for some data I ran on the back of an envelope, and I can't find it, unfortunately.

But we concluded that the combination of the expendable launch fleet—again looking at the Battelle study is what I used as a data base, and I looked at the 10-year Battelle study—and trying to tell you how close that relates to the existing NASA manifest I can't tell you. But using that, it appears to us that the available U.S. ELV industry can accommodate one shuttle equivalent comfortably—the missing shuttle's payloads.

Mr. Barton. Let me ask a question about pricing.

Dr. Lovelace, if I understood your testimony correctly, wanted one price. And if I understood Mr. Slayton's testimony, he wanted a more variable price structure so that smaller vehicles could have a lower price, and larger vehicles higher prices.

I would like a little more comment on the pricing structure.

Mr. **Lovelace**. Let me just see if I can clarify—I may have left a wrong impression by my testimony.

What I meant by a transparent pricing policy is transparent to the customer. If I come in with a communications satellite, I want to know how much it is going to cost me. I would like to have my schedule accommodated as to when I can go. And I guess beyond that, given the reliability of the systems is all high, I guess I really don't care which one you assign me to.

Now, if there is one caveat in there if we go to dual compatible spacecraft—that is to say, require or it is desirable for the spacecraft to be integrated with two different launch systems. There is an additional increment of cost that is accrued to the user.

But it ought to be transparent to the user, the customer of the launch service. He ought not to have to pay a premium to go one way or the other.

Mr. **Barton**. Do you want the customer to come to the Government and have the Government assign the launch vehicle, or would you rather the customer either go to General Dynamics or to Mr. Slayton's outfit?

Mr. **Lovelace**. Let me answer. I would like to see him go to Mr. Slayton and then come to General Dynamics. Let me tell you my concern right now. The Government—in this case in the form of NASA—has a number of customers signed up for shuttle launches. I do not know as I sit here what their plans are to honor those commitments to those customers.

I think it would be presumptuous of me to rush in there, even if I could rush in there and say, I really want to honor their commitments.

I think they need to study the problem and come to the Congress with a——

Mr. **Barton**. You are saying their commitments—you are talking about NASA's commitments to the——

Mr. **Lovelace**. Yes; I don't know the number, but they must have been getting some progress payments from some of their customers; they must have earnest money from others. They need an opportunity to address that and for the Government to decide how they want to orchestrate the solution to that problem.

Mr. **Barton**. Mr. Slayton, would you care to comment on that?

Mr. **Slayton**. I think in the case Dr. Lovelace is talking about where there has already been a negotiation with the Government, there's money involved; certainly they have to have a role in deciding what are we going to do with this particular payload.

I think independent of that, though, if you are talking new payloads that are not signed on or not making progress payments, I would propose that you follow the rule I have got here. The customer was just notified, "hey, we can't accommodate you on the shuttle until 19—whatever year it happens to be; so go find yourself a commercial launcher." Then you are in a free market situation. And if our company fits, which it won't for telecommunications, he would come to us, but he probably would go first to Dr.

Lovelace. He might end up talking to Ariane, too, as a matter of fact. But you are going to end up in a free market situation.

I don't think the Government can dictate it from that point.

Mr. **Barton**. That is all, Mr. Chairman.

Mr. **Nelson**. OK.

Mr. Andrews, of Texas.

Mr. **Andrews**. Thank you, Mr. Chairman. I appreciate the introduction.

Can NASA meet the obligations right now that they have outstanding? Can they meet those contracts?

Mr. **Lovelace**. I don't know the answer to that, Mr. Andrews. I would only be speculating, because I really don't know. I know what they were manifesting in the years that I mentioned. I really do not know the state of all their business arrangements. I am sorry, but I am just unknowledgeable in that.

Mr. **Andrews**. Have we made a mistake as a Congress in not emphasizing the ELV program enough? Have we put too much emphasis on the shuttle program? I know what Deke's view is about it and I am curious, Dr. Lovelace, what yours is.

Mr. **Lovelace**. Let me answer that, Mr. Andrews, this way. I do not believe that the Congress has put too much emphasis on the shuttle program, No. 1. I, in fact, believe that the Congress has been farsighted in their support of the shuttle program and as my statement indicates, that I am desirous of seeing that continued.

I do believe that, however, we may have lost sight of the desirability of having an expendable launch vehicle capability that is a complement to the unique capabilities of the shuttle space transportation system. I am, as I indicated in my statement, recommending to this committee that the Government really reconsider that. We need that robust industrial base; and then more than that is a free enterprise commercial base. I think that is a strength to the country.

Mr. **Andrews**. OK.

Mr. Slayton, applying your three-prong criteria to what the commitments are that we have right now that NASA has, how many of those payloads, of those missions, could be done with ELV's; could your company accept?

Mr. **Slayton**. I don't know that our company could handle any of them. I think all I did was do a shuttle equivalency study and I converted that by the normal conversion between Delta's and Atlas class vehicles. I think I came up with an equivalent of 27 Delta class payloads per year to accommodate what I would dump off using my criteria against the Battelle study.

Mr. **Andrews**. Is there a market out there right now?

Mr. **Slayton**. There must be for that number of payloads, if you have the capacity to handle them; yes, sir. I think it is a question of how do you split them up? Again, we are looking into the detailed manifesting—and I played the gross numbers game which doesn't really tell you the right thing. It gives you an approximation but you have to do what Dr. Lovelace is talking about and go and check the real payload against its configuration, its development status, integration, and find out what can be accommodated somewhere else.

There are a number of them, I am sure, that by basic design will not go on anything but the shuttle today, although they might have been designed to go on an ELV at some earlier point.

Mr. **Andrews**. How many tests of your launch vehicle are going to be necessary before it is operational?

Mr. **Slayton**. We think we don't need any more testing. Again, that is based upon the large backlog of, like I say, 1,600 motor firings on Castor 4's and 1,400 on STARS. We have asked ourself that question along with a lot of other folks over a period of time. The obvious question is, if that is not enough, how many is? We think the integration of those motors is a simple, straightforward task. We are not dealing with a manned vehicle where we have to design to a 1.3, 1.4 factor of safety. When in doubt, you build a 2. We are dealing with a very simple structure. So we have high confidence in the reliability of those, and we, frankly, see no merit in going out and flying a bunch of test flights. We are going to fly payload. Not to say we are not going to lose one. I will guarantee you we are going to lose one if we fly long enough; everybody is going to lose one. Nobody is that smart. But we think we can run with a reasonable record of reliability for an extended period of time, starting from where we are today.

Mr. **Andrews**. Thank you, Mr. Chairman.

Mr. **Nelson**. Mr. Walker of Pennsylvania.

Mr. **Walker**. Thank you, Mr. Chairman.

I guess you have to start with my assumption here, but I think it is a pretty good assumption based upon your previous testimony, and that is, that there are several Government payloads—Government-oriented payloads—that are probably adaptable to ELV flights at the present time. If in fact we were to take some of those Government payloads and decided to guarantee to the private ELV community four flights a year—as an arbitrary number—in order to allow you to become directly involved in the flight process.

What impact would that have on the commercial community's ability then to offer expanded services beyond those four flights a year?

Mr. **Lovelace**. I think that, Mr. Walker, the guarantee of four Government launch vehicle requirements a year would provide a base upon which I think any company could be very much more comfortable; and then proposing the incremental costs for additional vehicles for use in the commercial launch service.

I think the thing that would cause me though, from a commercial standpoint to pause, would be the thought that in that commercial arena I would still be competing with the shuttle, and I guess I have convinced myself that in the current environment that I really am noncompetitive in a price standpoint with the shuttle. So that is an element that is still very much there.

I certainly would have a better base, I agree, that would help me to compete, but I still believe I would probably not be competitive with the shuttle pricing.

Mr. **Walker**. Is it reasonable, though, to think that even if we get back in the early 1990's to a four-orbiter fleet—which I think that this subcommittee is intent upon doing—that by that time there would be payloads sufficient to more than fill that four-orbiter fleet, plus also have some loads available to the commercial community as well? So, therefore, that you would be competitive simply from the standpoint that there is an excess of lift capacity needed?

Mr. **Lovelace**. The only point I have right now is that we were really trying to do that up until the loss of the *Challenger,* Mr. Walker, unsuccessfully.

Now, if there is some projection that launch requirements will grow substantially, then possibly, with a fixed fleet capability and fixed flight rate, there is an overflow. But if you are the high priced supplier on the street, you are the last person that gets approached in the purely commercial environment.

Mr. **Walker**. I think in the short term, though, we can pretty much see that with only three orbiters operating that there are some things that are probably needed. When you get to the 1990's and and when you have a fourth orbiter coming on line, say early in the 1990's, in none of those projections have we looked at delivery of SDI; very few of those projections anticipated any space station loads, and that is going to be precisely the timeframe in which shuttle capacity is going to be needed for those things. It seems to me that the very things that need to be carried to orbit right now in the time when we have a three orbiter fleet will continue to need to be carried to orbit in the early 1990's as well.

What I am suggesting is if you had a base of say four flights a year that the Government was assuring, couldn't we assume at that point that that might be enough of a base to pick up some of that capacity that would emerge in the early 1990's?

Mr. **Slayton**. I think from our vehicle point of view the answer is a positive yes. That is what my boss likes to call a kick-start, and we would be up and running good with that; and I think we can build a very solid commercial business that would continue to flow through.

I can't answer for Dr. Lovelace, but it is my opinion that your postulation is exactly correct in the early 1990's based on the data we have looked at. Once the shuttle is in the support mode on a space station it is going to require its unique capabilities to do that job to a large extent. I still think there is going to be a lot of commercial business that is going to continue to carry on through the ELV industry.

Mr. **Walker**. Let me give you another scenario, and maybe you can comment on both of them at the same time. What if in the short run we decided to make the shuttle available for only shuttle-unique payloads? What would that do in terms of pushing the commercial community ahead?

Mr. **Lovelace**. I am thinking, Mr. Walker. I guess I am having a little difficulty in decided what a shuttle-unique payload is. If a shuttle-unique payload is a communications satellite that is 1-foot long and 15 feet in diameter, and flies for $15 million, or $10 million, it could be shuttle-unique. That is tough competition for a commercial launch service to compete with.

I hope I am not quibbling with you, I am not sure what is unique.

Mr. **Walker**. No; you raise a legitimate issue. I think what I am suggesting is that we know that there are some payloads that have been designed specifically for shuttle, that probably are not adaptable at the present time to going onto an ELV. However, there are some payloads that probably could be transferred to ELV without redesign, or without substantial redesign. So what I am saying is, what if in the short term we made a decision, in light of a reduced capacity, that we were going to limit the shuttle to only those things that are really shuttle-unique—that that is the only way that they can get to orbit—and allow the commercial community to come in and take over some of the capacity that is non shuttle-unique? How much of a spur would that be to the community?

Mr. LOVELACE. I think that it would be a spur. We have not done this as indicated earlier in answer to a question. Our analysis has not been of the total launch requirements that are upcoming beyond that 1989 horizon—there clearly are some and there are going to be some that are pushed out there.

I think I would very much like to see the policies that accompanied that decision for the future; that is, the future beyond 1989. Because if I later have to compete again with the Government in terms of launch service costs, I really don't believe that that is going to happen. I think you are going to find it very difficult for the industry, who may have to make relatively large upfront capital investments and risk investments in order to get their pipelines flowing again, to be willing to do that. That is what worries me.

That is why I believe that there are probably a couple of things that have to happen. One is a transition for these class payloads in which the Government may have to play a role for a while upfront by purchasing and providing a service, and then transition out, and accompany that transition out with a clear policy and actions that allow there to be a free enterprise competition.

Mr. WALKER. One last question. You have been very generous, Mr. Chairman, but one last question.

What is the soonest that each of you would be in a position of flying a Government payload if in fact we made the decision to assign you Government payloads to pick up reduced capacity?

Mr. SLAYTON. Twenty months.

Mr. WALKER. About 20 months?

Mr. SLAYTON. Right. Twenty months from tomorrow morning we can launch.

Mr. LOVELACE. We have some assigned already we are going to launch this month, so let me skip over those.

Mr. WALKER. I am talking about new.

Mr. LOVELACE. New?

Mr. WALKER. Yes, new.

Mr. LOVELACE. I think the earliest that we could see this would be by the first half of 1988. Let me explain that there are some engines available—there's one ship set of engines available—and you could go out and build an Atlas today and launch it by mid-1988. Your next launch would be some months after that, as you begin to get new hardware flowing—and it is more like a 30- to 36-month period, from scratch, to start getting new Atlas vehicles to the launch pad.

Mr. WALKER. So it is not really practical to think in terms of Atlas launches filling the gap between now and the time we could put a new orbiter on line—filling that line with Atlas launches, is what you are telling me?

Mr. Lovelace. I don't think that in a timely sense it is easy for any of these more complex launch vehicles to fill that gap. You can reorder some of the existing assets, but even there you are not going to, I think, solve the problem.

The difficulty, however, Mr. Walker—we got a fourth orbiter in, let's say, a 3-year period, you are going to have a tremendous unsatisfied backlog in front of you that you are simply going to push in front of you for many, many years; or else it is going to go overseas, or disappear.

Mr. Walker. Or we find other ways of satisfying that requirement, namely——

Mr. Lovelace. Fiberoptics—if you want to get out of the satellite business, start laying fiberoptics.

Mr. Walker. I thank you. Thank you very much, Mr. Chairman.

Mr. Nelson. I have got a number of questions to just sort of clean up and tie some loose ends together.

We are in a tremendously exciting field here because in the face of tragedy it has brought us together to force ourselves to look at what we really want to do, and how we are going to do it. We know that commercial activity in space is just very important to this Nation.

We started this process, fortunately, last summer, when we started the Assured Access to Space hearings—we got the Air Force and NASA together, and they started coming out with some very productive sessions where they were talking about a stable of combined vehicles and so forth. So here we are, and we are very fortunate to have you gentlemen of enormous credentials—Dr. Lovelace, having been the Acting Administrator of NASA; Mr. Slayton having been almost everything in NASA, including the impossible job of being head of the astronaut office. And now you being in the commercial realm—both of you—to bring your expertise to us.

Now, let me just sort of clean up a couple of questions here.

Dr. Lovelace, you were talking about the Atlas-H and the Atlas-E's, and you mentioned that some of the payloads had already been assigned to those vehicles. Tell us about that.

Mr. Lovelace. These launch vehicles, Mr. Nelson, are property of the U.S. Air Force right now and are scheduled for certain Air Force payloads which I really cannot discuss in this forum; but they are planned to be utilized for those purposes. They are launched, as I said, but I will say again, from the Western Test Range.

Mr. Nelson. Do any of them not have payloads assigned?

Mr. Lovelace. Again, I hate to sound so vague on this. There are some of the outyear Atlases that it is not clear to me that their mind is completely set on what payloads are assigned there. But they are assets that are available in which they—if I might make the analogy—have the flexibility because of the availability of the vehicle to orchestrate the assignment of the payloads, and it gives them more robust capability. But I believe some of the outyear Atlases are not specifically assigned as of today.

Mr. Nelson. You mentioned the possibility of additional complexes that could be reactivated. You said two other complexes at the cape could be reactivated. Do you have any idea about how much cost that would be?

Mr. LOVELACE. I do, Mr. Chairman. The two that I referred to were the 36A complex—that is the companion launch complex to 36B, which is now apparently operational as an Atlas launch pad. The 36A is configured right now to accommodate shuttle Centaur. That, we believe, could be reactivated for $12 million, and there would be an additional cost of probably $24 million to relocate the shuttle Centaur test stand in the vicinity of the 36A and B pads.

Pad 13, which was the former Atlas/Agena pad operated by the Air Force and utilized by the Air Force, was deactivated I think in 1976, 1978. We had an inspection team in to look at it. The tower, in fact, looks in very good condition. All of the consoles and launch control equipment was stripped out of the blockhouses. But the power is there; everything is there to allow for the reactivation. We estimate that to be about $33 million, and you could get capability for Atlas launches from that pad—and those pads, all three of them, 36A, B, and complex 13, have nominally each five launches a year capability, on a steady state. They have done more on some of those in a single year but I think on a year in, year out basis, they could handle five per year.

Mr. NELSON. Do you want to venture to share with us over the next few years what would be the annual number of payloads that would be compatible with your launch vehicles?

Mr. LOVELACE. Let me, I guess, in part answer the question that one of your colleagues asked a moment ago. One of the things we did was take the 64 payloads that we felt were impacted by the loss of the shuttle capability. Assuming that it comes back on in a year, at a 14-flight rate per year, those 64 payloads can be accommodated by the existing ELV capabilities, a combination of Atlas, Atlas/Centaur, and the CELV/Centaur. The CELV/Centaur is in development by the Department of Defense and will be available in the early 1989 time period, but particularly for the very heavy, 6,000-plus pound payloads, there being at least five of those that could be handled very easily, as a matter of fact, by the CELV Centaur.

Mr. NELSON. OK. So you are talking about all payloads, commercial and military?

Mr. LOVELACE. We were talking about commercial and military. We were looking to see whether we could be of assistance to the Department of Defense in the global positioning satellites, for example—which happen not to be particularly heavy payloads, but a very important constellation of spacecraft to be gotten up in the next several years.

Mr. NELSON. Do you have any idea what your price would be to your commercial customers?

Mr. LOVELACE. It depends, obviously, on a lot of factors: which vehicle you want, and rates per year, but let me just pick something more or less out of the air. I keep studying this and trying to find that single prime number but it——

Mr. NELSON. It is illusive, isn't it?

Mr. LOVELACE. It is illusive. But I would say on a two-to-four-per-year rate, we are talking maybe $65 to $74, $75 million launched for an Atlas. That is like 5,200 pounds into geotransfer orbit and about one-half of that up into the geosynchronous—about 2,600 pounds.

Mr. NELSON. It doesn't happen to adjust weekly like the stock market does, depending on what the price of the Ariane is?

Mr. LOVELACE. No, I am afraid I don't have that luxury. I wish I did, Mr. Chairman. I brought their latest news release about the the fact they had adjusted it to, let me see, what was their choice of words—it said, "decided to increase export price to take into account the important changes in the value of the dollar." I am having a hard time dealing with that.

Mr. NELSON. What, by the way, are the Chinese going to do? They have announced they are going to have a launcher. Do you have any idea about its capability and price?

Mr. LOVELACE. I am sure they will have a launcher. Some years ago I had the opportunity for a little bit closer view of their capabilities. I have no idea what the price might be or what it would cost them. I suspect initially, like most of us entering the launch vehicle business, that they will be rather modest payloads. They are more likely to be Mr. Slayton's competitor.

Mr. SLAYTON. I might volunteer, Mr. Chairman.

Mr. NELSON. Yes.

Mr. SLAYTON. I have had some conversations with them on that subject, and the best price I have got—they say tell us what is the best you can get and we will beat it. So they are prepared to underprice anybody.

Mr. NELSON. Deke, let me ask you the same questions about your annual number of payloads that are compatible with your launch vehicles.

Mr. SLAYTON. I have got to be honest with you, Mr. Chairman. I don't have high optimism we are going to find very many. There are a number of smaller payloads on the shuttle but most of them fit my definition of needing to go on the shuttle—either require a manned interface or they require recovery, and, of course, we can't do either of those.

So trying to find those in our payload range that don't have that—we hope there will be a few but we have no great optimism there is going to be a large number.

Mr. NELSON. Do you have any idea about price?

Mr. SLAYTON. Yes, sir; our going in price with our vehicle is $13 million, and we are willing to negotiate down from there. We have got start at that point. And depending again, as Dr. Lovelace said, on where you launch from and how many do you want, et cetera, we are very flexible. But that is our going in number.

Mr. LOVELACE. We ought to look at strapping a couple of Conestogas on an Atlas and see what we could do.

Mr. SLAYTON. We would be delighted to have you do that. [Laughter.]

Mr. NELSON. We have done a service for assured access to space.

Mr. BARTON. We get a finder's fee for that.

Mr. NELSON. It can go toward an application of reducing the deficit.

OK. Let me ask you this question. What would be the expense that users would have to incur to modify a spacecraft to fly in your ELV's, those that would have been coming from the shuttle?

Mr. **Lovelace**. Mr. Chairman, that is not, obviously, a fixed number for all variety of spacecraft. You really would have to get in and examine each of them, make sure they are designed to handle payload environment and loads, depending upon which upper stage they used. Obviously, they were designed to handle the shuttle payload environment and loads. You would have to go through a very careful analysis of that. You can be talking about as little as a few million dollars to reintegrate a payload from shuttle onto an ELV. However, in some cases, you could be talking about much more.

It is much a function of the spacecraft design and the orbits. As Mr. Slayton has said, the particular orbit that they want to achieve.

Mr. **Nelson**. OK. I wanted to clarify, or expand upon your statement: "With modest improvements, the Atlas can provide launch services for additional payloads which previously had only shuttle or Ariane from which to choose."

Mr. **Lovelace**. Yes; we believe that the existing fleet of Atlases can in fact offer an alternative to the vast majority of the payloads that are impacted. We have also done a preliminary design on a vehicle which has a 6,000-plus capability which we had in mind some months ago as a potential contender, or competitor, not with the shuttle, but with Ariane. That development could be completed and provide an economical alternative launch vehicle.

Mr. **Nelson**. In order for us to get the price quote that you made earlier in the proper context, tell us how many Atlas/Centaurs equal one shuttle cargo bay equivalent.

Mr. **Lovelace**. Again, a difficult question, because the length, really, is the critical dimension for the shuttle payload bay. I would guess it probably takes at least two—one never can manifest—well, I shouldn't say never. It is difficult to manifest the shuttle to 100 percent. I don't know what we have been achieving this last year, but, you know, it may be in the order of 80 percent effective utilization of the payload bay. That is an answer.

I would like to go back and examine and provide some corrections for the record if I am off base on that, Mr. Chairman.

Mr. **Nelson**. OK.

Both of you want to share with us what kind of investment you think will be required to activate your production lines?

Mr. **Lovelace**. Let me answer from our perspective, Mr. Chairman, in the following way. If we turned on our vendor suppliers as well as our own long-lead material in anticipation of production of four or more Atlas vehicles a year, and then terminated it in 90 days—I am speaking about termination liability. What am I exposing my company to? That is in the order of $8 to $10 million.

Mr. **Slayton**. Our nonrecurrings to get to a first flight are about 12—that includes launch site. Some of that goes in primarily to TVC and getting the line going, but most of that is TVC development.

Mr. **Nelson**. OK.

Look beyond, then, the production line and let's talk about improvements that need to be made in your vehicles to keep pace with what you anticipate to be the changing needs of your customers, if any. So, tell us about what are the improvements that you would anticipate, and how much would they cost.

Mr. LOVELACE. Let me start by saying, Mr. Chairman, that as I indicated earlier, that the current Atlas family of vehicles, virtually without change, can supply a great deal of capability. Beyond that, I referenced earlier the prospect of a heavier lift commercial competitive launch vehicle. I think we would have to contemplate probably strapping on some solids—I wasn't being quite so facetious in my comments about Conestoga—that would enhance our lift capability. We have not costed all the nonrecurring to do that. But I would guess that it might be the order of $60 to $75 million, to do the nonrecurring, complete the design, do the sufficient testing that would be needed because we would be exceedingly jealous of our reliability record that we have with Atlas, which is, you know, the order of 97 percent.

I wouldn't care to cut any corners there in a rush to achieve a new capability.

Mr. NELSON. OK. We are basically going to have 5 minutes, so let me see if I can wind this up here before we have to take off to vote.

How about you, Deke, how about future improvements and cost?

Mr. SLAYTON. Well, we have always planned once the market became more solidified and we could define better where it was, that we were prepared to grow into it. And we have got a pair of near-term options: One we are looking at pretty hard, is to go to a liquid upper stage to replace our two solid upper stages. And, again, if we can do that cost effectively it gives us a lot of flexibility and increased performance.

We would go with a hypergolic upper stage. We do not have a good cost number that goes with the development of that. It would be something equivalent to the Agena, and I have talked to the Agena folks about what is involved in a system of that size. And we are probably—if I want to do an off-the-head guess—be in the $5 to $10 million range, but that is about the best I can give you there.

We have also looked at some bigger solids as a baseline—what Thiokol calls a Castor 5, which is a paper motor at this time—that would increase our basic capability by a factor of two. But that is about as far as we have gone. We are looking at expanded capabilities, and I do not have a cost number that goes with that.

Mr. NELSON. Do you have any idea about how many launches a year you have to have to break even?

Mr. SLAYTON. We have priced our basic orbital vehicles to break even on three flights.

Mr. NELSON. Three?

Mr. SLAYTON. Three.

We are looking at some suborbital vehicles to support some of the Star Wars stuff, and we have priced that to break even at 10. Again, that is matched against programmatic knowledge of what the programmatic requirements are.

Mr. NELSON. I see.

How about you, Alan?

Mr. LOVELACE. We could, I think, find it very break even, to use your terminology, at even two per year, given that we saw horizon that was beycnd 1 year. If you were to talk about 10 vehicles, two a year for 5 years, then you see I am able to do economical lot ordering. I can order 10 ship sets of engines; I can get my guidance and control sets; and so forth. And that is what really gets your costs down and helps you to manage that.

Mr. NELSON. OK.

I assume that your equation changes dramatically if in fact the Department of Defense is ordering more of your launchers?

Mr. LOVELACE. It certainly is a function of the total base; you are absolutely correct.

Mr. NELSON. Then your additive cost of constructing those additional ones drives your price way down?

Mr. LOVELACE. That is correct, sir, because there are some nonrecurring costs, for example, for starting up the MA-5 rocket engine line again, and once you have paid those you have the capacity to handle probably the civil and the military requirements that might come to those vehicles.

Mr. NELSON. Let's assume you don't have that base of DOD orders out into when you are trying to be competitive, with this as a commercial launcher. Can your Atlas be competitive with what you project to be the various stages and costs of Ariane?

Mr. LOVELACE. That is again, to use Mr. Slayton's analogy, is pretty much like competing with the Chinese. They may charge just slightly under what the traffic can bear. That being the case, I will never make it up on volume if I meet them. It just isn't going to happen.

Mr. NELSON. So is that to say that what we need to look at is whether or not we think that from a national policy, we need to have a commercial ELV industry; and if we think so, then we better be prepared to do some subsidy of it because of the Ariane pricing policies?

Mr. LOVELACE. To get it started, I believe that is correct. Then I believe you can have a sustaining industry that can support our domestic needs. And if our international competitors want to continue in the loss leader business, that certainly can be their choice.

Mr. NELSON. We are going to run on and vote.

Do either of you have any further thing you wanted to share?

Mr. LOVELACE. Not I, sir.

Mr. NELSON. We thank you all very much.

We will finish this part of the testimony and will go into recess and then we will come back with Dr. Waylan and Mr. Hoernig. So the committee will stand in recess.

[Recess.]

Mr. NELSON. Good afternoon.

When we got to the floor to vote that was on an amendment, then we had to hold there to then vote on final passage on the bill. So that just took a lot longer and we apologize for it but that is part of the hazards of life on Capitol Hill. Thank you all for being so patient. We are looking forward to hearing from you. Dr. Waylan, why don't we start with you.

STATEMENTS OF C.J. WAYLAN, PRESIDENT, GTE SPACENET CORP., AND OTTO W. HOERNIG, JR., VICE PRESIDENT, SPACE SYSTEMS, AMERICAN SATELLITE CO.

Mr. **Waylan**. Mr. Chairman, I am Jerry Waylan, president of GTE Spacenet.

Nearly 4 months ago I had the privilege of testifying before you on the impact of insurance availability on the commercial U.S. domestic satellite industry.

Today we are addressing an issue of far greater magnitude—assuring access to space. I appreciate the opportunity to share with you our views on this topic of critical importance.

GTE Spacenet has about 400 members in 13 States. We have three satellites in operation at present and plan to launch three more during 1986, including one next Friday. GTE has a significant ground station investment in various locations in addition to that in satellites. This represents a substantial commitment on our part to participate in the commercial satellite industry.

The United States is becoming increasingly dependent upon satellites for its telecommunications needs. These include, in addition to the traditional telephone and television services, emerging, innovative applications such as interactive data networks using very small terminals, video conferencing and satellite news gathering.

In general, the U.S. Government has fostered policies which have led to the opportunity to deploy and operate substantial numbers of satellites providing service to the public.

This has been in large part due to the Federal Communications Commission's "open skies" policy to permit the maximum entry into the domestic satellite business, and the maximum utilization of orbital locations and associated frequency bands.

The FCC's approach has also considered the financial viability of applicants which works in the public interest by authorizing only those entities which are able to implement their systems on a timely basis.

Through the "open skies" policy, the FCC has authorized several domestic communications satellite companies which are currently providing service in both the 6 and 4 gigahertz "C" band, and 14 and 12 gigahertz "Ku" frequency band. The projected number of operational transponders by the end of this year is more than 400 in C-band and more than 130 in Ku-band. Existing operators such as GTE Spacenet and others, as well as new satellite operators authorized by the FCC in 1985, plan to place into service even more transponders over the next few years.

In order for these business plans to be implemented in a timely way to provide these important telecommunication services, reliable launch services must be available. GTE Spacenet has a launch scheduled on an Ariane vehicle next Friday. Later this year, we will launch still another of our satellites via Ariane.

Prior to the tragic loss of *Challenger*, we had planned for a satellite launch on the shuttle in November of this year. We and other satellite operators are now faced with uncertain dates for future launches. This uncertainty will require operators to revise business plans and may seriously affect their ability to deliver service to users.

Looking toward the future, we realize that Congress will want to consider what type of launch programs will best serve the needs of the United States. The goals of these programs are multifaceted, including securing the national defense, promoting space exploration, advancing scientific knowledge, and facilitating the provision of commercial telecommunications services.

It has long been recognized that despite the many unique and advanced capabilities of the space shuttle, it is not the optimum vehicle for all applications. For example, the type of launches GTE Spacenet requires, deployment of commercial communication satellites into geostationary orbit, are better suited to unmanned, expendable launch vehicles. These advantages include lower costs, simpler design, less complex deployment techniques and avoidance of employing a manned vehicle unnecessarily.

Because of the recent unfortunate loss of *Challenger,* the Congress should carefully evaluate the U.S. launch vehicle program and give serious consideration to the establishment of a viable expendable launch vehicle program. Such a program, while requiring several years to implement, would provide the United States with an essential complement to shuttle launches. An expendable launch vehicle program would promote U.S. technology and enable many U.S. military and commercial launches to go forward on a more cost effective and timely basis.

In addition, an expendable launch vehicle program would allow the shuttle program to concentrate on important scientific and space exploration and commercialization missions for which it is very well suited.

Adding this essential diversity to the U.S. launch capability will permit better competition with the current and planned expendable launch vehicle programs of other countries. The United States will be better able to cost effectively provide a sizable share of satellite launches, for both domestic and foreign users.

In order to be viable, an expendable launch vehicle program must be comprehensively planned. It must be backed by the resources to provide cost effective, highly reliable and continually advancing capabilities as well as a high degree of schedule certainty.

It is very likely that in view of the significant risks and capital requirements necessary for such a program, that direct government involvement will be essential for its success. This conclusion is made particularly evident in view of the difficulties being encountered obtaining insurance coverage for launch risks. While we understand that the U.S. Air Force is planning to proceed with an expendable launch program for military satellites, we believe a program which can be utilized for commercial satellites is imperative.

As a result of the current absence of such an expendable launch program and the future launch schedule uncertainties, the U.S. Government must continue to permit all available launch services, including non-U.S. launches, to be fairly accessed. Existing U.S. tax and export laws in this regard should not be modified to create a perceived incentive to use shuttle launch services.

In closing, I congratulate the subcommittee for its interest in this subject and I have confidence that the U.S. Congress will act to maintain U.S. leadership in space through new initiatives such as a viable and widely available U.S. expendable launch vehicle program.

Thank you.

Mr. NELSON. Thank you.

[The prepared statement of Mr. Waylan follows:]

Remarks of C. J. Waylan
President, GTE Spacenet Corporation

Before the
Committee on Science and Technology
Subcommittee on Space Science and Applications
U.S. House of Representatives

March 6, 1986

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The U.S. is becoming increasingly dependent upon satellites for its telecommunications needs. These include, in addition to the traditional telephone and television services, emerging, innovative applications such as interactive data networks using very small terminals, video conferencing and satellite news gathering. In general, the U.S. government has fostered policies which have led to the opportunity to deploy and operate substantial numbers of satellites providing service to the public. This has been in large part due to the Federal Communications Commission's "Open Skies" policy to permit the maximum entry into the domestic satellite business, and the maximum utilization of orbital locations and associated frequency bands. The FCC's approach has also considered the financial viability of applicants which works in the public interest by authorizing only those entities which are able to implement their systems on a timely basis.

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Looking toward the future, we realize that the Congress will want to consider what type of launch programs will best serve the needs of the U.S. The goals of these programs are multi-faceted, including securing the national defense, promoting space exploration, advancing scientific knowledge and facilitating provision of commercial telecommunications services. It has long been recognized that, despite the many unique and advanced capabilities of the Space Shuttle, it is not the optimum vehicle for all applications. For example, the type of launches GTE Spacenet requires, deployment of commercial communication satellites into geostationary orbit, are better suited to unmanned, expendable launch vehicles. These advantages include lower cost, simpler design, less complex deployment techniques and avoidance of employing a manned vehicle unnecessarily.

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Mr. **Nelson**. Thank you.

Mr. Hoernig.

Mr. **Hoernig**. Mr. Chairman, I appreciate the opportunity to discuss with you today some of the implications of the commercial use of space, particularly in the light of the recent tragic loss of the STS *Challenger*.

American Satellite Co. is a telecommunications common carrier who has pioneered the use of space in providing voice, data, facsimile and video communications services. American Satellite Co. has been in business since 1972 and today operates a network comprised of over 250 large satellite earth stations which serve industry and government.

American Satellite Co. has made a significant capital investment in these earth stations and their associated telecommunications equipment. These earth stations depend on the availability of satellite transponders in geosynchronous orbit to provide the essential connectivity that forms American Satellite Co. custom tailored communications network.

As a major communications common carrier, particularly a space dependent carrier, American Satellite Co. is the first U.S. company to become profitable through the commercial use of space-based resources, specifically communications satellites.

A large number of customers remain dependent on us for our special high speed and exceptionally accurate transmission services. American Satellite Co. pioneered commercial satellite communications and has become a recognized leader through the continued gowth of this commercial space-based industry and by providing quality service to its customers.

To provide continuity of quality service, American Satellite Co. and other satellite carriers must have assured access to space to replenish and to expand its space-based telecommunications resources.

Initially American Satellite Co. leased transponder capacity on Western Union's WESTAR satellites. As business expanded, ASC bought a 20-percent equity ownership in the WESTAR series of satellites.

In 1981, the need became apparent to acquire our own satellite system to provide sufficient capacity to serve our growing customer needs. We filed with the FCC to buy three communications satellites and were subsequently authorized to procure three and to launch two.

At that time there was a question about the availability of the STS and of expendable launch vehicles to economically place our satellites into orbit.

We made a decision, therefore, to specify a spacecraft design that could be most economically launched on either the STS or on ELV's. Subsequently, the space transportation system became operational and demonstrated a capability to satisfy the requirements for launching our satellites.

In signing the launch services agreement with NASA we made a full commitment to use the STS and accepted the Federal Government's promise that the STS could and would meet our launch requirements. We then directed our resources to designing and procuring the hardware, processing capabilities, and related support documentation specifically for STS launches.

On August 27, 1985, our first wholly owned communications satellite, ASC–1, was launched and deployed by STS 51–I. This year, our second satellite, ASC–2, will be ready for launch on the STS. ASC–2 is required to be placed into operational service by the first quarter of 1987 to meet our current business requirements and commitments.

We are particularly concerned that there now does not appear to be timely assured access to space by either STS or U.S. ELV's. The impact of this affects both American Satellite Co. and potentially our customers.

The primary impact on American Satellite Co. is the cost associated with a launch delay and the consequential delay of service. Changing the launch of ASC–2 from the STS to an ELV would also cause significant business impact. Not only would we be faced with the schedule delay but also with significantly increased insurance costs and the need to re-accomplish the launch vehicle interface hardware, procedures and documentation in making a transition to an ELV. There would also be a significant business impact because of the constraints on ELV lift capability. For example, ELV's do not have the flexibility to accommodate payloads of varying mass properties.

More specifically, the present Delta launch vehicle will not provide the lift capability for an economically viable launch of ASC–2. The Atlas and the Titan launch vehicles, if they were available in a timely fashion, could provide sufficient lift capability, but their high cost would preclude making an adequate return on our investment or offering of a competitively priced service.

A launch delay will also impact American Satellite Co.'s customers. Our customers have strategic and economic priorities that are as important as the priorities of most of the STS users. Our networks carry Government and commercial communications that affect not only the security of this country but the business transactions of hundreds of major corporations. The growth of these companies and the jobs they provide depend, in turn, on continued expansion of their capabilities of the new communications services provided by American Satellite Co.

Government and industry must be responsive to this current crisis with the most expeditious return of the STS to full operational service. A responsiveness was demonstrated 2 years ago after the failure of the WESTAR and PALAPA spacecraft perigee rocket motors, when a new rocket motor nozzle cone had to be developed to achieve the necessary reliability for the PAM–D launch system. This fix carried with it the penalty of potential spacecraft stationkeeping fuel reduction to compensate for increased weight of the new rocket motor nozzles.

Fortunately, the STS had the flexibility to mitigate the effects of the added weight by flying ASC–1 to a nigher deployment altitude which provided the capability to achieve the originally planned mission objectives for PAM–D class spacecraft.

Since ELV's do not have this flexibility, ASC–2 would suffer a weight penalty if launched on the expendable Delta 3920. This weight penalty would result in a loss of approximately 1 year of orbital life. It should be noted that Ariane has some design flexibility to place heavier spacecraft into orbit than the Delta at a comparable cost with the STS.

It is indeed unfortunate that we do not have a fleet of U.S. expendable launch vehicles that could provide assured, timely, and cost-effective access to space. Today the only economically reasonable expendable launch vehicle alternative to the STS for American Satellite Co. to consider is the Ariane. American Satellite Co. must have a timely availability of capable launch vehicles to meet not only the current but future requirements. In addition to ASC-1 and 2, the FCC has also granted American Satellite Co. authorization to construct and launch a third satellite.

In signing the launch services agreement with NASA, American Satellite Co. made a hard financial commitment to ensure that our spacecraft, launch, and processing operations and procedures would be primarily compatible with the STS launch vehicle.

American Satellite Co. and other commercial users have worked with NASA to make the STS a viable, operational space transportation system for commercial application.

Mr. Chairman, we are concerned that as the backlog for NASA and DOD launches grows, we, the commercial satellite owners and operators, the pioneers of space commercialization, will be abandoned.

The STS must remain the primary national resource to promote and expand space commercialization. In order to respond to the President's national space policy, there must be an adequate fleet of STS orbiters complemented by a range of available cost-effective ELV options.

In the near term, assured access to space for commercial customers cannot be provided by a limited fleet of launch vehicles when commercial customers are at the bottom of the priority list and there remains a backlog of DOD, NASA, and other Government space missions. We further believe that comparable priorities should be given and must be given for commercial launches to provide the necessary assured access to space.

Thank you for allowing me to speak to you on this vital issue. This concludes my prepared remarks.

[The prepared statement of Mr. Hoernig follows:]

March 6, 1986

Statement By

Mr. Otto W. Hoernig, Jr.
Vice President, Space Systems
American Satellite Company
on
Assured Commercial Access to Space

before the

Subcommittee on Space Science and Applications
Committee on Science and Technology
United States House of Representatives

Mr. Chairman and Distinguished Members of the Subcommittee:

I appreciate this opportunity to discuss with you some of the implications to the commercial use of space in light of the recent loss of the STS Challenger.

American Satellite Company is a telecommunications common carrier who has pioneered the use of space in providing voice, data, facsimile and video communications services. American Satellite Company has been in business since 1972 and today operates a network comprised of over 250 large satellite earth stations which serve industry and government. American Satellite Company has made a significant capital investment in these earth stations and their associated telecommunications equipment. These earth stations depend on the availability of satellite transponders in geosynchronous orbit to provide the essential connectivity that forms American Satellite Company's custom tailored communications network. As a major communications common carrier, particularly a space dependent carrier, American Satellite Company is the first U.S. company to become profitable through the commercial use of space-based resources, specifically communications satellites. A large number of customers remain dependent on us for our special high speed and exceptionally accurate transmission services. American Satellite Company pioneered commercial satellite communications and has become a recognized leader through the continued growth of this commercial space-based industry and by providing quality service to its customers. To provide continuity of quality service, American Satellite Company must have assured access to space to replenish and to expand its space-based telecommunications resources.

Initially American Satellite Company leased transponder capacity on Western Union's WESTAR satellites. As business expanded, ASC bought a 20% equity ownership in the WESTAR series of satellites. In 1981 the need became apparent to acquire our own satellite system to provide sufficient capacity to serve our growing customer needs. We filed with the FCC to buy three communications satellites and were subsequently authorized to procure three and to launch two. At that time there was a question about the availability of the Space Transportation System (STS) or Expendable Launch Vehicles (ELV) to economically place our satellites into orbit. We made a decision, therefore, to specify a spacecraft design that could be most economically launched on either the STS or an ELV - specifically the Delta 3920 or Ariane 3. Subsequently, the space transportation system became operational and demonstrated a capability to satisfy the requirements for launching our satellites. In signing the launch services agreement with NASA we made a full commitment to use the STS and accepted the Federal Government's promise that the STS could and would meet our launch requirements. We then directed our resources to designing and procuring the hardware, processing capabilities and related support documentation specifically for STS launches.

On August 27, 1985 our first wholly owned communications satellite, ASC-1, was launched and deployed by STS 51-I. This year, our second satellite, ASC-2 will be ready for launch on the STS. ASC-2 is required to be placed into operational service by the first quarter of 1987 to meet our current business requirements and commitments.

We are particularly concerned that there now does not appear to be timely assured access to space by either STS or U.S. ELVs. The impact of this affects both American Satellite Company and its customers.

The primary impact on American Satellite Company is the cost associated with a launch delay and the consequential delay of service. Changing the launch of ASC-2 from the STS to an ELV would also cause significant business impact. Not only would we be faced with the schedule delay but also with significantly increased insurance cost and the need to reaccomplish the launch vehicle interface hardware, procedures, and documentation in making a transition to an ELV. There would also be a significant business impact because of the constraints on ELV lift capability. For example, ELVs do not have the flexibility to accommodate payloads of varying mass properties. More specifically, the present Delta launch vehicle will not provide the lift capability for an economically viable launch of ASC-2. The Atlas and Titan launch vehicles, if they were available, could provide sufficient lift capability, but their high cost would preclude making an adequate return on our investment or offering of a competitively priced service.

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Government and industry must be responsive to this current crisis with the most expeditious return of the STS to full operational service. A responsiveness was demonstrated two years ago after the failure of the WESTAR and PALAPA spacecraft perigee rocket motors, when a new rocket motor nozzle cone had to be developed to achieve the necessary reliability for the PAM-D launch system. This fix carried with it the penalty of potential spacecraft stationkeeping fuel reduction to compensate for increased weight of the new rocket motor nozzles. Fortunately, the STS had the flexibility to mitigate the effects of the added weight by flying ASC-1 to a higher deployment altitude which provided the capability to achieve the originally planned mission objectives for PAM-D class spacecraft. Since ELVs do not have this flexibility, ASC-2 would suffer a weight penalty if launched on the expendable Delta. This weight penalty would result in a loss of approximately one year of orbital life. It should be noted that Ariane has some design flexibility to place heavier spacecraft into orbit than the Delta at a cost comparable with the STS.

It is indeed unfortunate that we do not have a fleet of U.S. Expendable Launch Vehicles that could provide assured, timely and cost-effective access to space. Today the only economically reasonable Expendable Launch Vehicle alternative to the STS for American Satellite Company to consider is the Ariane. American Satellite Company must have a timely availability of capable launch vehicles to meet not only current but future requirements. In addition to ASC-1 and 2, the FCC has also granted American Satellite Company authorization to construct and launch a third satellite.

In signing the launch services agreement with NASA, American Satellite Company made a hard financial commitment to ensure that our spacecraft, launch and processing operations and procedures would be primarily compatible with the STS launch vehicle. American Satellite Company and other commercial users have worked with NASA to make the STS a viable, operational space transportation system for commercial application.

Mr. Chairman, we are concerned that as the backlog for NASA and DoD launches grow, we, the commercial satellite owners and operators, the pioneers of space commercialization, will be abandoned. The STS must remain the primary National Resource to promote and expand space commercialization. In order to respond to the President's National Space Policy there must be an adequate fleet of STS orbiters complemented by a range of available U.S. ELV options. In the near term, assured access to space for commercial customers cannot be provided by a limited fleet of launch vehicles when commercial customers are at the bottom of the priority list and there remains a backlog of DoD, NASA and other government space missions. We further believe that comparable priorities should and must be given for commercial launches to provide the necessary assured access to space.

AMERICAN SATELLITE COMPANY

OTTO W. HOERNIG, JR.

BIOGRAPHY

Otto Hoernig is Vice President, Space Systems at American Satellite Company and is responsible for the design, development, acquisition, and operation of the American Satellite Company satellite system.

Prior to joining American Satellite Company, Mr. Hoernig was an independent satellite communications consultant to industry and government.

Mr. Hoernig has 25 years of experience in technical and management aspects of satellite systems including conceptual design, development, integration, test, launch, and operation of numerous DoD, NASA, commercial, and international satellite systems. During Mr. Hoernig's Air Force career he was responsible for formulating the technology concepts and needs for future military satellite communications systems. Mr. Hoernig also directed the engineering for the communications satellites of the Air Force Satellite Communications System.

Mr. Hoernig has successfully directed satellite systems engineering, environmental test facility operations, space systems architectural planning activities, satellite launch operations, and communication satellite system acquisition programs.

Mr. Hoernig received a Bachelor of Science degree in Mechanical Engineering from Texas A&M University in 1960 and his Masters degree in Aerospace Systems Management from the University of Southern California in 1969.

Mr. NELSON. Thank you very much.

Do you have a recommendation for us as to the immediate future of what the U.S. Government should do?

Mr. HOERNIG. I think it is very important that the U.S. Government support the use of the STS to accommodate commercial launches as well as the national security launches. I think we should be given a comparable priority to other launches, with the exception of national security launches. I think we ought to also continue with an ELV program and support an ELV program.

It has become apparent in this crisis that we are in today that the United States needs both the STS, and an adequate fleet of STS vehicles, and the ELV's.

Mr. NELSON. I appreciate that and, of course, you can tell by our questions that is the direction in which we are moving. I don't think that you are going to see the commercial customers put on short shrift on this thing.

Let me ask you this, Mr. Hoernig: In the meantime, could you or your customers lease some of the excess transponder capacity owned by others to fill the void during this delay until we get the shuttle up and flying again?

Mr. HOERNIG. Certainly. In fact, that is the way that American Satellite Co. entered this business initially, leasing transponders. We have augmented our own transponder resources with lease transponders. Even today, we still lease transponders. We lease one from Dr. Waylan's company currently. We would view that leasing transponders is a significant part of our business plan.

However, one of the problems in providing network services through satellite transponders is the need to aggregate transponder capacity on certain satellites. That is very important to us. And that was one of the major factors that drove us to acquiring our own satellite system, so that we would have better control of our assets and also for the price in a competitive marketplace.

Mr. NELSON. Your company is headquartered in Atlanta, isn't it?

Mr. HOERNIG. No; our company is headquartered in Rockville, MD. Our satellite operations control center is in Atlanta. That is our primary control center for our network operations as well as our satellite operations.

Mr. NELSON. OK.

Let me ask Dr. Waylan—you talked about, and I quote you: "For example, the type of launches GTE Spacenet requires: deployment of commercial communication satellites in geostationary are better suited to unmanned expendable launch vehicles . These advantages include," and you list a host of advantages, including lower cost.

Tell us about that. How is it ELV's are offering you lower cost than from the STS?

Mr. WAYLAN. I don't mean that they offer us a lower cost. My view is that one looks at the cost of providing the service from the launch vehicle. I think that is a pertinent consideration, even though from our point of view as a user, when we were making our launch vehicle decisions for our original system of satellites, the shuttle was the lowest cost to us. But in my judgment, and I believe it is shared by most people in our industry, launching satellites from the space shuttle is more costly than launching satellites from expendable launch vehicles to the provider of those launch services.

Mr. NELSON. Now say that last statement again.

Mr. WAYLAN. In my judgment, and in the judgment of those people, I believe the majority of people in our industry, the cost to the launch organization to launch a satellite from the space shuttle is greater than from an unmanned vehicle. Of course, that depends very much on the numbers of launches, the size of the organization, and where the nonrecurring costs of development were put, and very many things. But my judgment is that it is still more costly to launch a simple, if you will, communications spacecraft such as we have been launching, by an unmanned vehicle.

Mr. NELSON. In actual dollars, does it come out that way, and the price that has been quoted to you from NASA?

Mr. WAYLAN. I need to differentiate again between the price to us and the cost to provide the service. I am addressing in that statement the cost to provide the service. The price to us currently would be comparable between the Ariane vehicle and the space shuttle, which are the only two vehicles which we believe need to be compared to know what the comparison would be today. But we don't believe the costs are reflected fully in the price.

Mr. NELSON. OK.

Do you want to comment on any of the glut of transponder capacity on orbit? How long that might keep us going?

Mr. WAYLAN. I am happy to comment on it. I think that in order to comment intelligently we have to separate C band and Ku band. I will assume that the different characteristics of the two bands are familiar to the committee. I believe that the C band currently has approaching 400 transponders. As I mentioned in my testimony, by the end of the year, I believe there will be 400, approximately, C band transponders in orbit.

I believe that in the order of 60 to 70 percent of these transponders are currently in use. I think that a utilization factor of approximately 80 percent is the right utilization factor. That gives room for sparing backup in the event of unexpected failure, growth, and expansion of existing networks.

In the Ku band, by the end of the year our projections are there will be around 130 transponders. The growth rate for this band is substantially higher, however. Most of the new capacity which is expected to be brought on line over the next few years will be in the Ku band. We expect the number of Ku band transponders to overtake the number of C band transponders within the next decade.

The utilization of the Ku band capacity which is up there now is no higher than C band. It is perhaps 50 to 60 percent. But that is where all the new and innovative services are being provided. The interactive data networks for retail stores and gasoline stations, et cetera, where there are thousands of terminals being installed right on the premises, uniquely well suited to satellite, cannot be satisfied by fiber optics, and certainly can't be satisfied by alternative techniques as cost effectively.

We believe, and this is unique to the Ku band, because of the ability to locate these terminals right on the premises, whereas, you can't reasonably expect to do that in the majority of cases with C band.

We believe that the growth of those new services will cause the supply and demand difference, or the decrease of the glut, as you referred to it, over the next 5 years down to levels which are tolerable and attractive. So that those satellite operators in this industry continue to make acceptable profits and continue to make this a viable industry.

Mr. NELSON. Do you have any scheduled payloads that were scheduled for the shuttle that you think you might have to move off the shuttle? Give me an idea about your future.

Mr. WAYLAN. Mr. Chairman, we have a launch scheduled in November, November 6 of this year, on the space shuttle. It has clearly been delayed. It is uncertain as to when it will occur. We believe that the delay will be in excess of a year.

Mr. NELSON. Whereas, Mr. Hoernig, you said you have one scheduled for the first quarter of 1987?

Mr. HOERNIG. Yes, January 1987.

Mr. WAYLAN. That satellite, we currently expect to place it in orbital position for Federal Express and operate it for them until such time as they have their own satellite system, referred to as Express Star, in place. And at such time, we would move it out.

The reason for doing that, for your information, is that once one gets thousands, and even tens of thousands, of terminals, in Federal Express' case, pointing at that orbital position—repointing all of those is a very expensive proposition. So we will operate our satellite from there. That is the satellite that we have agreed with Federal Express to operate from their position. So it is imperative that we get it up in a timely way, because as they grow on our other satellites, all these earth stations are being installed, and the cost and difficulty, and interruption in service to relocate, to repoint them, is becoming more and more expensive, and more and more inconvenient.

So we will certainly look to alternatives for that launch vehicle. But we are not abandoning the space shuttle. We believe that the space shuttle is a very important national resource, national asset. We must support it. We don't in any way deny its value. So we will launch another satellite than that one, perhaps, on the space shuttle. The satellite that we have planned to launch on there will be launched in one form or another at some time under current expectation of what the shuttle will do.

Mr. NELSON. If your satellite is launched 1 year later under your hypothetical, what will that do to you? What are the business ramifications for you?

Mr. WAYLAN. I could get back to you on some specific business ramifications, and we will do that. The nature of those business ramifications are, quite frankly, investment tax credits, when they can be taken; the schedule for insurance and insurability of a satellite; and the cost for launch; the lost opportunity, if you will, to put new users on that spacecraft. And then the one which I mentioned which is the inability to provide the service to our current contracted customers in the manner that they expect.

Mr. NELSON. In the earlier panel with regard to Mr. Slayton and Dr. Lovelace, my colleague, Mr. Walker, had asked the question about whether or not it would be a good policy to require all non-STS-unique payloads off of the STS and onto ELV's. You heard the testimony that generally the ELV companies thought that this was a good idea. All right, you all are users. What do you think?

Mr. **Hoernig**. Mr. Chairman, I think it is a bad idea. That is a fairly simple and succinct answer. But right now, I think, as you listened to the previous testimony of Dr. Graham, as you listened to the other gentlemen who testified today, there is not a stable of available U.S. expendable launch vehicles to take up the backlog of nonunique shuttle payloads. That does not exist. That is why it is imperative that we put the shuttle back into commission and operational service at the earliest possible date; expand the fleet adequately to take care of the backlog, the backlog that most certainly will exist; and I think that an ELV program must be continued. I think ELV's are very important. They are very important to us.

As Dr. Waylan pointed out earlier, they improve the competition in the industry. I think we all like to see a very competitive industry, those of us in business. So we feel very strongly that ELV's are very good. But we don't think that it is a good idea to restrict satellites that are not shuttle-unique to ELV's, primarily because ELV's cannot respond both in the lift capabilities, the cost effectiveness, and in the quantity of launches that would be required to take up the slack.

Mr. **Nelson**. If you move a payload off the shuttle because of the accident caused delays, has NASA given you any idea how they are going to handle the refund, or any money that you put up front?

Mr. **Waylan**. Mr. Chairman, I don't think that is fully resolved. There have been some discussions by our staff and NASA officials, but I don't believe that there is a clear policy on that at this point.

We would expect that the policy that has been in existence for a number of years would be followed. My recollection of that policy is that if the launch is scheduled for in excess of a year after the termination action is taken, that it would be a total payment of 10 percent of the total value. That is my recollection. We can correct that if that is in error.

There is another important consideration, and that has to do with one of the disadvantages of using the space shuttle—an upper stage has to be separately procured. We currently have paid well in excess of $10 million for a PAM-D2 upper stage for that launch in November. That is a separate contract that we as an operator had to administer with McDonnell Douglas, and there is no such refund policy on that part of the launch.

Mr. **Nelson**. Earlier I had asked Dr. Waylan about what he would do if his satellite were to be launched a year later. You have one coming up the first quarter of 1987. What would you do, Mr. Hoernig?

Mr. **Hoernig**. As I look at the alternatives today, the STS is the only viable alternative, other than Ariane, a foreign launch vehicle, capable of a launch earlier than a 1-year delay. American Satellite Co.'s policy, maybe largely because American is in our name, has been to buy American. But certainly from a business perspective, we are exploring other opportunities, including the Ariane, to place our spacecraft in service more consistent with our business plan.

Certainly if we were delayed and there was no availability for either the ELV's or the STS, then we would be required to go lease additional transponders. We have a certain reserve of transponders that we keep. As Dr. Waylan points out, it is prudent in this business to keep in reserve a certain percentage of your capacity to take care of contingencies. I think to a large extent all of us in this business do that.

And when we talk about a glut in the transponders, those transponders that are retained in contingency cannot really be considered as part of a glut.

Mr. NELSON. Mr. Hoernig, you had said on the last paragraph of your statement, the STS must remain a primary national resource to promote and expand space commercialization. In order to respond to the President's national space policy, there must be an adequate fleet of STS orbiters.

How many?

Mr. HOERNIG. I certainly think that the orbiter fleet of four orbiters would be a good start. I am not sure that that will be adequate in the 1990's. But certainly we must take that first step today to start being responsive to those needs of the future—at least a four orbiter fleet. Particularly when you take into consideration that the orbiter, like any other flying aircraft, has to be down for maintenance; and there is no assurance that you can keep four flying continuously—you must have a fleet of some size in order to accommodate and provide that assured access to space.

Mr. NELSON. Do either of you have to modify your spacecraft in any way to make it compatible with an ELV? And as you say, Dr. Waylan, the ELV alternative is Ariane.

Mr. WAYLAN. Mr. Chairman, I think that is a more complicated question than it appears on the surface. ELVs are not fungible, and ELVs are not routinely the same; there are many, many characteristics that are different. From the standpoint of a spacecraft, if it is designed from the beginning to go onto an expendable, a specific expendable launch vehicle and the space shuttle, utilizing a specified third upper stage, then that transition is not too difficult.

At some point in the program almost always, though, the two paths depart, and you can't continue to maintain full compatibility, but you can certainly maintain a large degree of that compatibility.

We have purchased our spacecraft from RCA in New Jersey. Those satellites were designed from the beginning to be able to be launched on either the space shuttle or Ariane. The transition from a satellite intended for the space shuttle to Ariane is somewhat simpler because of some programmatic decisions we made than the reverse. But they can be done, and done fairly cost effectively.

For example, if we would take a Spacenet satellite which is one of the two systems of satellites that we have, it would be less than $2 million to modify it from Ariane to go on the space shuttle, as far as we have gotten. For a GTAR satellite to go on an Ariane after having been planned for the space shuttle is a nominal amount.

Mr. NELSON. Do you all want to venture some planning with us here as to what ELV's you think the United States ought to have in its stable of ELV's?

Mr. WAYLAN. I would welcome the opportunity to do that but I am sure it is not going to be satisfactorily specific, because I don't think it is time to be that specific. I would urge, Mr. Chairman, that a program of expendable launch vehicles that's complementary to the space shuttle be planned out, well planned out, not a near-term fix, but a long-term policy that is viable. I think we haven't had that, and we need that.

I would like to see, for example, an Expendable Launch Vehicle Program that perhaps consisted of more than one type vehicle, but certainly consisted of a vehicle which had multiple payload capabilities by different combinations of stages and strap ons. This country has great success. It has been the leader in doing that, but has fallen behind.

I would like to see an organization structured to be able to marry commercialization advantages with Government ability to accept risk, and finance advances, and do R&D. I think that can be done. I think NASA needs to get back into the business of expendable launch vehicles, not in a minor way, and not with the expectation of abandoning it in a few years, but get into it in earnest.

I think the consortium of companies in the United States could put together a very viable Expendable Launch Vehicle Program that consisted of more than one launch vehicle, and could give this country the kind of range of launch vehicle services that it needs.

Mr. NELSON. I want to follow that up, on the question of a consortium. You are talking about long term now, or the plannings?

Mr. WAYLAN. Yes, sir.

Mr. NELSON. Now, were that to occur—suppose you had either a consortium that developed a stable of ELV's for the long term to complement the space shuttle, even complement into the next century, whatever the vehicle will be. Then what should we as policymakers in the Government do in order to guarantee that those U.S. ELV's are going to be ridden by U.S. companies, or should we do anything?

Mr. WAYLAN. Why would you care? I personally, as a citizen, wouldn't care.

Mr. NELSON. You said there ought to be some subsidy somewhere along the line. One of the two of you, or both of you, said in your testimony that the United States was going to have to be involved in this from a taxpayer dollar standpoint.

Mr. WAYLAN. I certainly said that in my testimony. But I am not aware of a single launch vehicle program that hasn't been, that has been a provider of launch services for any period of time.

Mr. NELSON. OK, so if the taxpayers' dollars are involved in helping establish this industry, why wouldn't it be logical for the Government to assume that there ought to be a return on this taxpayer dollars, at least with U.S. payloads going on those U.S. ELV's as opposed going to foreign ELV's?

Mr. WAYLAN. I think that is a pricing issue. I think that the price for those launch services has got to be established with two considerations: One is cost recovery and return, if that is appropriate, and competitiveness and marketplace pressures.

But I do believe that it is imperative that this expendable launch vehicle capability be developed. I am not suggesting continuing subsidies. I am suggesting the Government do the initial R&D.

Take the initial risks, because there are no companies that I am aware of which currently in the United States really can step up to the kind of risks that are required, and the kind of an ELV Program that I am imagining.

Mr. Nelson. Dr. Waylan, you are a very high officer, you are the president and general manager of Spacenet Corp., and that is a subsidiary of GTE, isn't it?

Mr. Waylan. Yes, sir, it is. I am the president. The general manager was a typo on the list. I am just the president of GTE Spacenet and we are a subsidiary of GTE.

Mr. Nelson. GTE Spacenet is a subsidiary of GTE?

Mr. Waylan. Yes.

Mr. Nelson. You might want to have a conversation with some of the officers of your parent corporation, GTE, because they came to me about 6 months ago wanting to discuss the horrors of the international trade imbalance, while at the same time, GTE Spacenet was contracting to fly on the French Ariane. So there is a little inconsistency there and that is why I asked the question about the future.

If we are talking about helping foster—which I happen to agree with—on ELV industry, if we are going to have limited capability, or capacity, or priority capacity elsewhere on the shuttle, then what do you think about it, Mr. Hoernig, about a requirement that U.S. companies fly on U.S. ELV's?

Mr. Waylan. Mr. Chairman, could I respond to your earlier statement and interrupt before Mr. Hoernig continues?

Mr. Nelson. Yes.

Mr. Waylan. I am very well aware of those conversations, not the details of them, but that they occurred. But for the record let me say that when we contracted for the Ariane launch vehicle, our first preference was the space shuttle. The space shuttle was not available to us for more than 2 years from when we needed it. So there wasn't a decision made to fly Ariane rather than shuttle.

I think if there is an Expendable Launch Vehicle Program that is competitive both in capability and reliability, and cost, we absolutely, in GTE, want to buy American. We are not hurt by this loss of the *Challenger* in terms of the launching of our satellites nearly so much as many of our colleagues are. So I am not here today so much reacting to that. I am here today because I believe we need to do something and I am recommending that to this subcommittee.

Mr. Nelson. Mr. Hoernig.

Mr. Hoernig. Mr. Chairman, as I stated earlier, American Satellite Co.'s policy has been buy America. I think buy America goes a long way, but when it gets down to the competitive marketplace, price has to come to bear.

I think as Dr. Waylan points out, if the nonrecurring costs can be absorbed as they have in every launch vehicle to date by some Government entity, be it foreign or domestic, I think that domestic carriers will by first choice to choose an American vehicle, and I think that when you get into the true competitive marketplace, I think that American launch vehicles can become competitive. And I think that they can become a vehicle of choice.

Mr. NELSON. Last year we passed some commercialization legislation and we were going to try to commercialize ELV's. Where do you think we ought to go from there to now here in this situation that we are in, on into the future? You are talking about long term. Do you want to give us any specific recommendations?

Mr. HOERNIG. As I said earlier, or as Dr. Waylan also stated, and some of the previous people who have testified, no one launch vehicle is going to meet the needs. I think that there has got to be a stable of launch vehicles that range from Mr. Slayton's Conestoga-size vehicle up to the Atlas-size vehicle. And those vehicles will take care of a range of payloads, satellite and space missions, that can uniquely be flown on either shuttle or on expendable launch vehicles.

Now, I think that it is going to take Government subsidy on the NRE, the startup costs, to get these vehicles into the inventory. It is something that can't meet the current crisis that we have today. Those launch vehicles can't be into the fleet of launch vehicles and available resources for at least 2 to 3 years. There are very few vehicles today that can take up the slack and the backlog and meet the commercial needs.

Mr. NELSON. When you fly an ELV in the future, do you care whether it is a commercial owner or the Federal Government?

Mr. HOERNIG. I don't care, as long as the vehicle is competitively priced, is a reliable launch vehicle, and can meet our requirements.

Mr. WAYLAN. I believe I care. The reason I say I believe that is because I do think it is subject to how it is administered. But historically, my view would be that for our type of application, we are much more likely to be able to get the kinds of concessions and give and take in a business relationship with a commercial organization, and we are much less likely to be preempted for Government launches if it is a commercial organization. But that does not eliminate the need in order for me to make a decision to launch with a commercial organization, that that organization be viable, that that organization be able to take into consideration expected launches.

Deke Slayton made the point that there will be losses, and there will be, and there will be more. We all know that who have been in this industry for a number of years.

That organization, that commercial organization, who stands behind the launch agency that I would sign up for a launch up to 3 and 4 years in advance of the actual launch, must be able to withstand and recover from those launch failures; and must be able to continually improve the capability of the launch vehicle.

I have to, in order for our company to be competitive, be able to launch competitive payloads. That means the kinds of excess fuel that I can get on a spacecraft to extend its life. To give you a very real example: the PAM-D upper stage, using the space shuttle, if we had launched a Spacenet spacecraft on that launch vehicle combination, we would have gotten up to 1½ years, approximately 2½ years less life than we got by launching on Ariane. Two and a half years of life, when a satellite is generating anywhere from $10 to $15 million a year, is a lot of money.

Mr. HOERNIG. Mr. Chairman, maybe I was a bit too hasty in my comment. My comment was based primarily on the situation that we face right now today. I think right now today, whether it is a commercial or a Government-provided launch vehicle, I don't think that it makes much difference to any of us in this industry, whatever it takes to recover, to address the backlog, and to get us all into operational service.

What Dr. Waylan points out, I think, though, is very important in the longer range objectives that we in industry are most concerned about, and that is our ability to negotiate contracts that are firm contracts. And as I pointed out in my testimony, when we signed the launch services agreement with NASA, we made a commitment to fly on the space shuttle, and we felt that the Federal Government should also make that same commitment to us to provide us a launch vehicle that would meet our requirements and satisfy all of our mission objectives.

If you would look at the launch services agreements and the kinds of contract that that represents, the contract is extremely one sided. It is not a contract that one might negotiate in industry. I think that is very important in the longer term scheme of things to get equitable competitive position in the industry.

Mr. NELSON. Do either of your answers change if you were certain that the Federal Government would also be using the vehicle for an extended period of time?

Mr. WAYLAN. My answer wouldn't change. In fact, I believe that is a very important aspect of a viable program. I think the Government's use for Government payloads is essential. The more users that one has on an expendable launch vehicle, or any launch vehicle, the lower one can drive the price of that vehicle, or the cost of that vehicle, to the user. I would welcome that opportunity.

Mr. NELSON. Do any of you all have any further questions?

[No response.]

Mr. NELSON. Would either of you like to add anything further?

Mr. WAYLAN. No, sir. I appreciate the opportunity to share my views with you. Thank you.

Mr. HOERNIG. No, sir, and I thank you also.

Mr. NELSON. Is Dr. Lovelace still here?

[No response.]

Mr. NELSON. Since he is not here, Mr. Slayton, do you have any question of these gentlemen?

Mr. SLAYTON. No, sir. I heard the testimony and I thought it was very nice.

Mr. NELSON. Do either of you all have a question of Mr. Slayton?

Mr. HOERNIG. Why don't you get a bigger vehicle?

Mr. SLAYTON. I would love to do that.

Mr. NELSON. Thank you very much for your testimony, it has been most enlightening. We are still sorting through all of this question of assured access to space. We appreciate you all helping us through it. Thank you very much.

Mr. HOERNIG. Thank you very much.

Mr. WAYLAN. Thank you, Mr. Chairman, and we look forward to the opportunity to help more if it is appropriate.

Mr. NELSON. The meeting is adjourned.

[Whereupon, at 5:20 p.m., the subcommittee was adjourned.]

PRIVATE FINANCING OF A SPACE SHUTTLE ORBITER

WEDNESDAY, MARCH 19, 1986

House of Representatives,
Committee on Science and Technology,
Subcommittee on Space Science and Applications,
Washington, DC.

The subcommittee met, pursuant to call, at 1:30 p.m., in room 2318, Rayburn House Office Building, Hon. Bill Nelson (chairman of the subcommittee) presiding.

Mr. Nelson. Good afternoon. I appreciate your participation today, because today we are going to conduct another in our series of hearings on the question of assured access to space. We are trying to examine the available alternatives to replace our lost launch capacity, and today we are going to focus on the potentials for private financing of an orbiter.

Now back before January 28 NASA had formally canvassed the private sector trying to ascertain interest. We have heard in these hearings that both NASA and the Air Force agree that we need another orbiter to replace *Challenger.* We have also heard from this very same witness table testimony concerning the fact that the Air Force is going to look to some additional expendable launch vehicles. We are now awaiting the discussions that are going on in the Senior Interagency Group on Space down in the White House, and while we await their decisions concerning the lost launch capacity, we're going to have to continue to focus on the means to achieve our objectives, which is to have assured access to space at least through the rest of this century.

Our witnesses today have been invited to talk about the private financing, what their proposals are, and how it might proceed. It is my understanding that there has been no formal proposal made to NASA, and so what we're going to do in this hearing is enlighten all of us as to the probabilities for such private ownership in light of the circumstances that we now find ourselves.

So we welcome Al Rockwell, the chairman and CEO of Astrotech International. He is exploring opportunities to fund such an orbiter. Ike Gillam, our Assistant Administrator, will present the results of NASA's solicitation and tell us how NASA intends to proceed. We also have joining us Klaus Heiss, who had an effort back in 1982 to fund privately a shuttle. And various financial consultants are joining us today: James Samuels, from Shearson-Lehman; John Bliven, Bankers Trust; Jerome Simonoff, Citicorp; Brad

Meslin, the Center for Space Policy. So all of you, we welcome you, and we will proceed with you, Mr. Rockwell.

STATEMENT OF WILLARD ROCKWELL, CHAIRMAN AND CEO, ASTROTECH INTERNATIONAL CORP.

Mr. ROCKWELL. Thank you, Mr. Chairman.

You have a prepared statement which you can read and probably have already read, so I'll not bore you with a repetition of what's in it.

Mr. NELSON. As a matter of fact, that's exactly our style. We would prefer that you not sit there and read a written statement, but that you just talk to us.

Mr. ROCKWELL. All right. I believe I'm here because I've been intimately connected with space from the commercial operator's side since the time—early part of the Apollo Program to this very moment. And also because I represent the board of directors of a company, which is General Space Corp., that is probably the best sounding board in the country if not the world on space matters. Without reading their names, which are again in my prepared statement, let me tell you who they are by reputation: A former head or Administrator of NASA, who is currently a prominent adviser to the Government on space and SDI matters; a former astronaut who walked on the Moon twice and has continued to be active in space matters; the former head of Comsat, which has probably launched more satellites than any other commercial organization in the world; and probably the leading consultant in the world on satellites and a member of the Space Applications Board is here with us today; a former longtime NASA official and more recently the head of Johnson Space Center, Gerry Griffin, on my left; a former Secretary of the Air Force and head of FAA who was also a top executive in Comsat; and a former head of the National Science Board and president emeritus of Rice University, a well-known scientist; plus four successful entrepreneurs from the business world.

This board met on January 31 and urged me to offer funding assistance to NASA in view of the difficulty they saw in obtaining funds to keep America in the forefront of the space race.

Now with that background let me give your our analysis of this country's position in space today. We believe that with the loss of Challenger America has lost for the foreseeable future the commercial satellite launch business. We've been studying ELV's for some time. We see nothing that's in the U.S. inventory or on the drawing boards that'll win back our share of the commercial launch business except another shuttle, which we are told is some 3 years away. This is the opinion of this board of directors, and they will tell you that the commercial satellite launchers are going to go to the lowest cost operator, which of course at the moment and probably for the foreseeable future is Ariane Space. I have here an announcement, a release, that states they just landed their 44th launch contract, and I show you the type of promotional literature they're out selling with.

So what should this country go after in the lucrative space markets of the future? A McDonnell Douglas study made recently predicts a market of $5 to $10 billion in the 1985–95 time period for semiconductors and new materials. And that is the current period we're in, the current 10-year period which began last January. So they're looking at some very big figures. They also predict a $20 to $40 billion market in that decade for pharmaceuticals. So these are the markets we should be shooting for. But are we? As an entrepreneur all my life I cannot help but wonder what has happened to entrepreneurial America. The only corporate faces I see addressing these markets are McDonnell Douglas, 3M, John Deere, and one or two others, whom you are familiar with I'm sure.

So what do we need to prevent losing these markets by default to the Germans, other Europeans, or the Japanese or Chinese? First of all we need shuttles, if not to launch the space factories which are coming in 1988 to 1989, that soon, then we need them to bring their valuable payloads back to Earth, and you can't do that with an ELV or a parachute. Second, we need marketing to get the GE's, the Westinghouses, the Pfizers, and the big automakers, plus many, many others into the act. And you shouldn't expect NASA, whose mandate is research and development, to be a successful commercial marketer.

Well, our plan is brief—our plan in brief has the following elements. One, funds for the purchase of the orbiter will be derived from a combination of private and public offerings of General Space equity and debentures. Second, the assurance of General Space Corp.'s ability to raise these funds is tied to a long-term lease agreement with NASA, and General Space has been advised by major investment banks that with such a lease it will be possible to raise the funds required from the private sector. Third, NASA of course will assume responsibility for procurement, maintenance, and all ground and flight operations for the new orbiter as it has for all previous orbiters. And again General Space will propose to organize and operate an aggressive market-development effort designed to expand and encourage private-sector application and use of the Space Transportation System. We don't care whether you use the funding method we're offering or whether you use current appropriations, but we urge the Congress and the administration to move America off dead center and allow NASA to take immediate steps to produce a shuttle, or better yet, two shuttles, so that America can win this race.

In closing, let me repeat, you can launch with ELV's, but you can't maneuver in space or service the space factories that'll produce this wealth, get us into this tremendous space business, or bring their production back to Earth without shuttles. We understand of course that the desire for speed in construction of a replacement orbiter may mean that this committee will move ahead in considering supplemental funding before our discussions with NASA have progressed to a final, firm proposal. In that case we would hope and request that this subcommittee consider including some allowance for the use of private-sector funding to the extent that it is successfully raised—raised to displace appropriated funds. This would provide the necessary encouragement to the private sector to continue on the path toward full commercial development of space.

With that, Mr. Chairman, I'd be delighted to answer your questions.

[The prepared statement of Willard F. Rockwell follows:]

Statement of Willard F. Rockwell, Jr.
Chairman,
General Space Corporation

Subcommittee on Space, Science, and Applications
Committee on Science and Technology
U.S. House of Representatives

March 19, 1986

Mr. Chairman and Members of the Subcommittee, my name is Willard F. Rockwell, Jr. and I am Chairman of General Space Corporation. I commend the Chairman and Members of this Subcommittee for holding this series of hearings and for helping to bolster the nation's commitment to press on toward our goals during this difficult period following the tragic loss of Challenger and her crew.

General Space Corporation is at present a wholly-owned subsidiary of Astrotech International Corporation, a publicly held company I became chairman of in 1981 following my retirement from Rockwell International. Astrotech and its subsidiaries have been actively involved in the shuttle program, having processed eighty percent of all commercial satellites launched from the United States during 1985. In addition, through its subsidiary, General Space Corporation, formerly Space Shuttle of America Corporation, Astrotech has conducted extensive research and analysis regarding the commercialization and privatization of space. The space-related activities of Astrotech are currently being consolidated under General Space Corporation.

As we continue our efforts to determine and correct the cause of the Challenger tragedy, we must also consider steps to restore and enhance our manned space capabilities. The loss of Challenger, coupled with delays necessary to remedy the problems which created the disaster, have seriously undercut U.S. competitiveness in space. More disturbing is the fact that this disruption in the development of our Space Transportation System has a detrimental effect on national security as well as commercial applications of the shuttle program. Each day before our launch capability is restored represents increased vulnerability, and an erosion of America's position of leadership in the commercialization of space.

The recent launch of the Soviet space station, PEACE, emphasizes an important reality: the United States cannot afford to take its lead for granted. Like us, the Soviets recognize the enormous technological and economic potential of space. In 1985 alone, the Soviet Union launched 97 space vehicles . . . compared with a total of 17 by the United States.

The Europeans are also proving to be very strong competitors. In the present situation, they are well poised to take much of the commercialization initiative away from this country. The European Space Agency's ARIANE program is planning 28 satellite launches between now and the end of 1988 -- representing more than a billion dollars in income.

Japan, too, is developing launch vehicles and already soliciting commercial customers. A number of countries -- including China -- are following suit.

In other words, Mr. Chairman, this is a time of great ferment in the international space community -- and among an increasing number of major industries that will be affected by commercialization of space.

Our future leadership in such diverse worldwide industries as pharmaceuticals, semiconductors and advanced space communications -- in addition to aviation, electronics and other industries directly involved in the space program -- will depend on maintaining and enhancing our position of primacy in space transportation.

As the Members of this Committee are well aware, the whole history of the space program in the United States has been one of close cooperation between government and private industry.

I have been privileged to play some part in this process and to have seen it work -- as it has -- to give us our present position of world leadership.

Based on this experience, going back 20 years, I submit that it is now time for us to elevate this successful history of cooperation to a new level.

We are entering a new phase in space, a phase of commercialization in which we are being subjected to ever strengthening competition from other nations. The stakes are extremely high. Not only are billions of dollars of income at stake, but also the future competitiveness of many of our most important industries. It is a challenge which we cannot afford to take lightly at this critical point in our public debate over the space program.

NASA has recognized this challenge and has taken appropriate steps to encourage the private sector to become more involved in the program. It has pointed the way forward. Our appearance before you today is a part of the private sector's response to that challenge.

We feel it is an important response, worthy of your serious consideration. We feel it is an eminently practical response -- of benefit to the government, to our future capabilties in space, and -- last but not least -- of benefit to the American taxpayer.

What we are proposing is private sector funding for the construction of future shuttle orbiters -- and private sector marketing to help NASA regain its initiative and leadership position in the field of commercialization.

Our plan, in brief, has the following elements:

- Funds for the purchase of the orbiter will derive from a combination of private and public offerings of General Space Corporation equity and debentures. The exact amount for the purchase is to be determined.
- The assurance of General Space Corporation's ability to raise these funds is tied to a long-term lease agreement with NASA, wherein, over a period to be determined, NASA leases the replacement orbiter from General Space at lease rates favorable to the government.
- General Space has been advised by major investment banks that, with such a lease, it will be possible to raise the funds required from the private sector.
- NASA will assume responsibility for procurement, maintenance and all ground and flight operations for the new orbiter as it has for all previous orbiters.
- In addition to its responsibilities as lessor, General Space will propose to organize and operate an aggressive market development effort designed to expand and encourage private sector application and use of the STS.
- It will be proposed that incentive payments will be made by NASA to General Space for the described marketing,

subject to the success of the marketing activities. NASA and General Space will share in the incremental dollar gain from the commercial marketing activities.

We have already submitted this outline to NASA both as a preliminary step toward developing a formal proposal and as a response to NASA's January 22, 1986 Commerce Business Daily announcement concerning private sector purchase of a fifth orbiter. It is our desire to work with the Congress and NASA to establish the precise terms of this plan and to submit it to NASA in the near future as a formal proposal which will, we feel, enhance the strength of the shuttle program while freeing scarce federal resources for other activities.

Our initial discussions with the investment community show that the potential for private funding is there. Studies also show that there is an immense potential for commercial applications which has not yet been tapped, but could be realized through the kind of aggressive marketing of which we in the private sector of this country are certainly capable. There are, of course, difficult problems which remain to be solved before the shuttle is fully operational. At a time of intense pressure on the federal budget, our plan would help free NASA to commit its resources to solving those problems and to pursuing other aerospace research and development activities. With sufficient safeguards to preserve NASA's traditional and essential role in procurement, maintenance and ground and flight operations of the new orbiter, this plan would permit the agency to expand the scope of its programs without diminishing its authority over STS.

Naturally, there are certain aspects of the plan which will need to be worked out. Insurance will be one such hurdle, especially in light of the Challenger disaster, and there are, no doubt, others which will arise in further developing and implementing the plan. It is our intention to cooperate fully with the Congress and NASA to address each of these issues in a manner which protects the government's interests and enhances STS and other space programs.

Before concluding my remarks and answering any questions the Committee may have, I would like to describe briefly General Space Corporation.

As I mentioned earlier, General Space is now a wholly-owned subsidiary of Astrotech International. When our plan for private sector funding of a replacement orbiter is implemented, General Space will be owned largely by the American public. We are currently consolidating Astrotech's various space operations under General Space Corporation. These operations include Astrotech's successful shuttle payload processing facility, in which we processed 85 percent of all commercial satellites launched in 1985. The company's shuttle payload processing services are offered at a savings of 20 to 25 percent of the prices charged by NASA. This and other activities such as the Delta Astrotech Reusable Transfer Stage (DARTS) and the proposed orbiting power station demonstrate that General Space has the expertise and experience necessary to carry out its plan for private sector orbiter funding and marketing of shuttle launch capacity.

General Space Corporation is fortunate to have a board of directors which brings together a wide range of capabilities from the space program and the business community. The directors are, in addition to myself, Eugene A. Cernan, Dr. Joseph V. Charyk, Dr. Robert T. Filep, Dr. James C. Fletcher, Gerald D. Griffin, Dr. Norman Hackerman, Dr. Joseph P. Kazickas, Dr. John L. McLucas, Cruse W. Moss, Don N. Stitt, and E. Doug Ward.

Conclusion

Mr. Chairman, let me conclude by saying that General Space Corporation is firmly committed to assisting NASA to bring STS to full operational capacity, including private sector funding for a replacement or follow-on orbiter. We believe that with appropriate incentives, our company can help NASA to make the shuttle the commercial success it should be, capable of responding to the existing and anticipated future strong demand for commercial space activity.

STS is the ideal launch system to facilitate the varied and extensive commercial space activity that is forecast through the end of this century. In order for the shuttle to fulfill its potential, though, it is essential to move forward immediately to develop a replacement orbiter and to make the system fully operational. We believe we can greatly assist in that task through the marshalling of private sector resources. We understand, of course, that the desire for speed in construction of a replacement orbiter may mean that this Committee will move ahead in considering supplemental funding before our discussions with NASA have progressed to a final, firm proposal. In that case, we would hope, and request, that this Subcommittee consider including some allowance for the use of private sector funding, to the extent it is successfully raised, to displace appropriated funds. This would provide the necessary encouragement to the private sector to continue on the path toward full commercial development of space.

I would be pleased to answer any questions you may have.

WILLARD F. ROCKWELL, JR.
CHAIRMAN
ASTROTECH INTERNATIONAL CORPORATION

Willard F. Rockwell Jr. is chairman of the board of directors and chief executive officer of Astrotech International Corporation. He also serves as chairman of General Space Corporation, an Astrotech subsidiary.

Rockwell assumed the chairmanship of Astrotech International (then known as The Cyprus Corporation) in 1981 and has directed its transformation from an investment company into a diversified space-age firm with operating subsidiaries.

Under Rockwell's leadership, Astrotech has acquired or established operating subsidiaries in three areas of applied technology: the commercialization of space, aerospace metals and computer peripheral equipment.

He retired as board chairman of Rockwell International Corporation in 1979 after having held that position for more than 11 years.

He is also a director of Lone Star Industries, Inc., Magic Chef, Inc. and Planning Research Corporation.

An engineering graduate of Pennsylvania State University, Rockwell joined Pittsburgh Equitable Meter Company in 1935. The following year he was employed by Timken-Detroit Axle Co., Detroit, a forerunner of Rockwell-Standard. He returned to Pittsburgh Equitable Meter Co. in 1938, became vice president and controller, and was elected a director in 1940. The company's name was changed to Rockwell Manufacturing Co. in 1945.

Following service as a U.S. Army captain during World War II, Rockwell served as vice president and general manager of Rockwell Manufacturing. He was elected president in 1947, and became vice chairman and chief executive officer in 1964, and chairman in 1971.

In 1967 he was elected chairman of North American Rockwell Corp. following the merger of Rockwell-Standard Corp. and North American Aviation, Inc.

North American Rockwell became Rockwell International in 1973 and Rockwell Manufacturing was merged into that firm the same year.

Rockwell remains active in numerous international, national and local groups, including the Conference Board and the Allegheny Conference on Community Development in Pittsburgh.

He also serves on many boards of community organizations and universities.

He has received five honorary doctorates as well as awards from the American Astronautical Society, the American Management Association and the United Negro College Fund.

Mr. NELSON. All right. Thank you, Mr. Rockwell.

Let me just ask you to repeat the part of your—latter part of your testimony. I can't exactly paraphrase it, but in essence you said that you encourage the Congress to go ahead with the emergency appropriation to replace the lost *Challenger;* is that what you said?

Mr. ROCKWELL. Yes, we—I said we understand, of course, that the desire for speed in the construction and replacement of the orbiter may mean that this committee will move ahead in considering supplemental funding before our discussions with NASA have progressed to a final firm proposal.

Mr. NELSON. Conceivably not only this committee but conceivably the entire Congress.

Mr. ROCKWELL. Yes.

Mr. NELSON. OK. I think what we'll do is depart from the normal procedure. Mr. Gillam, if you'd come on up, let's hear your testimony, and then we'll get in the questions and we have opening statements from Mr. Walker and Mr. Lujan that will be inserted in the record, so let's proceed with you, Mr. Gillam.

[The prepared opening statements of Mr. Walker and Mr. Lujan follow:]

OPENING REMARKS
REPRESENTATIVE ROBERT S. WALKER
MARCH 19, 1986

GOOD MORNING, MR. CHAIRMAN. I AM ESPECIALLY PLEASED TO BE HERE THIS MORNING BECAUSE THE TOPIC OF OUR HEARING IS ONE OF PARTICULAR INTEREST TO ME. I AM PROUD TO SAY THAT THE COMMERCE BUSINESS DAILY ANNOUNCEMENT BY NASA WAS THE RESULT OF MY CONTINUED INTEREST IN ALLOWING THE PRIVATE SECTOR THE OPPORTUNITY TO FINANCE THE PURCHASE OF OUR NEXT ORBITER.

AT THE TIME I WAS DISCUSSING THIS POSSIBILITY WITH MR. GILLIAM NEITHER OF US HAD ANY IDEA THAT EVEN BEFORE THE RESPONSES WERE IN, WE WOULD LOOSE CHALLENGER IN A TRAGIC ACCIDENT.

BUT, I BELIEVE THAT IT IS A FITTING HONOR TO THE CREW OF CHALLENGER THAT THERE ARE STILL MEN AND WOMEN OF VISION WHO NOT ONLY WANT TO CARRY ON THE WORK OF OUR SPACE PROGRAM, BUT WHO ARE WILLING TO INVEST THEIR OWN MONEY IN AMERICA'S SPACE FUTURE.

MR. CHAIRMAN, I BELIEVE THAT TODAY WE STAND AT AN HISTORIC CROSS-ROAD ON OUR JOURNEY TOWARD MAN'S FUTURE. OUR GOVERNMENTAL RESOURCES ARE LIMITED, THERE IS EXTRAORDINARY PRESSURE FOR ALL AVAILABLE FUNDING, AND WE FACE YEARS OF BUDGETARY UNCERTAINTY.

IN THAT ENVIRONMENT WE ARE SUDDENLY FACED WITH THE NEED FOR TWO TO THREE BILLION DOLLARS TO REPLACE CHALLENGER AND TO RECOVER FROM THE ACCIDENT. I MUST TELL YOU THAT FINDING THAT KIND OF MONEY IN THE PRESENT CLIMATE WOULD BE NEARLY IMPOSSIBLE.

THE CHAIRMAN ALREADY KNOWS THAT I FIRMLY BELIEVE THAT A PRIVATE PURCHASE AND LEASEBACK OF AN ORBITER TO NASA WILL WORK. I INTEND TO DEVOTE MY TIME, AND MY EFFORTS, TO MAKE THIS CONCEPT BECOME A REALITY. BUT, LET ME ALSO SAY THAT WE IN THE CONGRESS HAVE A RESPONSIBILITY TO THE TAXPAYERS OF AMERICA. ANY AGREEMENT WHICH WOULD ALLOW A PRIVATE BUY-IN TO THE SHUTTLE PROGRAM WILL HAVE TO BE STRUCTURED IN SUCH A WAY THAT IT REPRESENTS A REASONABLE DEAL FOR THE AMERICAN TAXPAYER.

I LOOK AT THE SIX GUIDELINES THAT NASA USES TO EVALUATE PROPOSALS AND THEY MAKE EXCELLENT SENSE AND PROTECT THE TAXPAYER'S CURRENT INVESTMENT.

I LOOK AT MR. ROCKWELL'S STATEMENT AND WHAT HE IS PROPOSING TO DO. IT APPEARS TO ME THAT WE CLEARLY HAVE AN OPPORTUNITY HERE TO BRING THE SIDES TOGETHER AND TO REACH A SOLUTION WHICH WILL REPLACE OUR LOST ORBITER CAPACITY, SAVE THE TAXPAYERS MONEY, AND GIVE THE PUBLIC THE CHANCE TO BECOME DIRECTLY INVOLVED IN THE EXPLORATION OF MANKIND'S LAST AND GREATEST FRONTIER.

MR. CHAIRMAN, ON THE MORNING OF JANUARY 28TH THE CREW OF STS-51-L BECAME A PART OF HISTORY WHILE FACING THE CHALLENGE OF EXPLORING THE UNKNOWN AND BLAZING NEW TRAILS THROUGH UNKNOWN TERRITORY. I HOPE THAT WE, TOO, WILL BE WILLING TO BRAVE THE UNKNOWN AND CHART NEW WAYS TO FINANCE GOVERNMENT PROGRAMS. WHAT FINER MONUMENT TO THE CREW OF CHALLENGER THAN A NEW CHALLENGER II, FINANCED BY THE PRIVATE SECTOR, AND ONCE, AGAIN, REACHING FOR THE STARS.

THANK YOU.

THE HONORABLE MANUEL LUJAN, JR.
OPENING STATEMENT/NASA AUTHORIZATION HEARING
PRIVATE FINANCING OF SPACE SHUTTLE
MARCH 19, 1986

I BELIEVE THAT THIS HEARING WILL PROVE TO BE PIVOTAL IN OUR DISCUSSION OF HOW WE ARE GOING TO REPLACE OUR LOST LAUNCH CAPABILITY. MANY OF US BELIEVE THAT NOW IS THE TIME FOR THE PRIVATE SECTOR TO STEP IN AND PICK UP THE SLACK IN OUR SPACE TRANSPORTATION SYSTEM. THE LOSS OF THE CHALLENGER WAS A TRAGEDY FOR ALL US. BUT IT ALSO REPRESENTS AN OPPORTUNITY FOR OUR SPACE PROGRAM.

MANY OF US STILL BELIEVE THAT TODAY'S LOST LAUNCH CAPABILITY ALSO REPRESENTS A GOLDEN OPPORTUNITY FOR THE PRIVATE SECTOR. IT'S ALSO A GOLDEN OPPORTUNITY TO CHANGE THE WAY NASA DOES BUSINESS.

UNFORTUNATELY, TO THE BEST OF MY KNOWLEDGE, THERE ARE NOT YET ANY NEW PROPOSALS PUT FORTH BY THE PRIVATE SECTOR TO PRIVATIZE OR COMMERCIALIZE EITHER THE SHUTTLE OR ELVS. AMERICAN ENTREPRENEURS SEEM TO BE WAITING FOR THE GOVERMENT TO STEP IN AND SOLVE THE PROBLEM...PERHAPS THEY'RE EVEN WAITING FOR AN "URGENT SUPPLEMENTAL"...ONE THAT APPEARS TO HAVE LESS URGENCY EVERY DAY.

AS WE IN THE UNITED STATES--IN THE WHITE HOUSE, IN NASA, AND IN THE PRIVATE SECTOR--STAND BY WAITING FOR SOMEONE SOMEHERE TO MAKE A POLICY DECISION, THE FRENCH ARE MOVING SWIFTLY AHEAD.

RECENTLY, THE FRENCH COMPANY ARIANESPACE HAS ANNOUNCED THAT IT HAS EIGHT AVAILABLE SLOTS IN THE 87-88 TIME FRAME. ALMOST EVERY CUSTOMER SCHEDULED TO FLY ON THE SHUTTLE DURING THE 86-87 TIME FRAME HAS TALKED TO ARIANESPACE ABOUT LAUNCHING ON THEIR VEHICLE. FOR THE AMERICAN CUSTOMER LOOKING FOR ASSURED ACCESS TO SPACE IN THE NEXT FEW YEARS, THE NEWS IS EVEN WORSE THAN JUST NOT HAVING AN AMERICAN "HIGHWAY TO SPACE": DUE TO THE EVER-WEAKENING DOLLAR, THE COST OF A LAUNCH ON ARIANE HAS INCREASED ALMOST 35 PERCENT SINCE LAST JULY!

THE HEAT IS CLEARLY ON OUR SPACE PROGRAM. THE QUESTION IS: WHAT ARE WE GOING TO DO ABOUT IT?

THE ANSWER I HAVE ALWAYS FAVORED IS TO LET THE PRIVATE SECTOR STEP IN AND TAKE OVER WHEREVER POSSIBLE. IN THIS CASE, NO ONE HAS DONE THAT. WHAT I WANT TO KNOW IS: PRECISELY WHAT ARE THE PRIVATE SECTOR, NASA AND THE WHITE HOUSE WAITING FOR? I SINCERELY HOPE THAT THE ANSWER IS NOT THAT THE AEROSPACE INDUSTRY HAS, AS MANY PEOPLE ALLEGE, GOTTEN SO SOFT FROM FEEDING ON NASA AND DEFENSE CONTRACTS THAT IT SIMPLY DOESN'T WANT TO TAKE RISKS ANYMORE. I ALSO HOPE THAT NASA IS NOT IN THE PROCESS OF PUTTING ALL INITIATIVES ON AN "INDEFINITE HOLD OR SLOWDOWN" JUST TO KEEP OTHER PLAYERS OUT OF THE GAME.

THE IS A THIRD POSSIBLE ANSWER AND THAT IS: IT IS JUST NOT POSSIBLE NOW TO PRIVATIZE OR COMMERCIALIZE PARTS OF THE SPACE SECTOR, GIVEN THE COST OF INSURANCE, THE UNCERTAINTY OF WHEN AND HOW OUR SPACE TRANSPORTATION SYSTEM WILL FLY, AND THE GENERAL ECONOMIC CLIMATE. IF THIS IS THE CASE, HOWEVER, I'D LIKE THE EXPERTS TO LET ME KNOW. WHAT DISTURBS ME IS THE FACT THAT OUR RHETORIC ON SPACE COMMERCIALIZATION NEVER QUITE MAKES IT TO REALITY. IF THE TIME IS NOT RIGHT FOR THE PRIVATE FINANCING OF AN ORBITER, LET'S JUST ADMIT IT AND GET ON WITH OUR SPACE PROGRAM. IF THE TIME IS RIGHT, LET'S MOVE AHEAD. THE ONE THING WE CAN'T AFFORD TO DO IS WAIT FOR EVENTS TO TAKE OVER. POLICY DECISIONS, BASED ON SOUND FACT, NEED TO BE MADE NOW.

I LOOK FORWARD TO HEARING TODAY'S WITNESSES SET THE RECORD STRAIGHT.

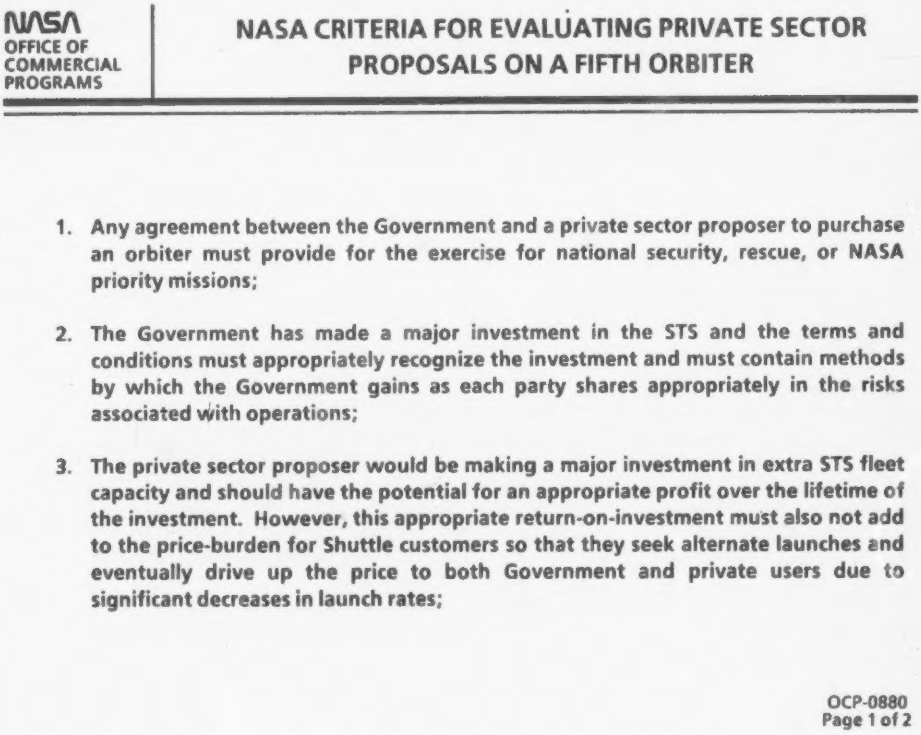
STATEMENT OF ISAAC T. GILLAM IV, ASSISTANT ADMINISTRATOR FOR COMMERCIAL PROGRAMS, NASA

Mr. GILLAM. Mr. Chairman, I too would like to submit my statement for the record and then just review very briefly in a conversational way some additional comments for the record.

I have available two Vu-Graphs. I will get to the Vu-Graphs very, very shortly. The first thing that I would like to say is that NASA began considering private-sector proposals for ownership or for the purchase on the part of the private sector of an Orbiter in 1982. The first proposai that we received was from the Space Transportation Corp. Dr. Heiss is going to testify very shortly on that proposal. At the time NASA formed an interagency team to review that proposal. We held discussions with Dr. Heiss and his group for over a period of about 6 months. We could not reach a resolution of some of the difficulties that we had with the proposal, and discussion was ended with a final letter from us to Dr. Heiss explaining what those insurmountable problems that we came to were.

A little later we had such a similar set of discussions with Mr. Rockwell and Astrotech on the purchase of a fifth Orbiter, and we sent to him when he first made his proposal a list of criteria that we had devised for evaluating the Heiss proposal, the Space Transportation company proposal, and those are the criteria that I'd like to review just briefly in Vu-Graph form for you.

The first Vu-Graph (fig. 1).



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NASA CRITERIA FOR EVALUATING PRIVATE SECTOR PROPOSALS ON A FIFTH ORBITER

1. Any agreement between the Government and a private sector proposer to purchase an orbiter must provide for the exercise for national security, rescue, or NASA priority missions;
2. The Government has made a major investment in the STS and the terms and conditions must appropriately recognize the investment and must contain methods by which the Government gains as each party shares appropriately in the risks associated with operations;
3. The private sector proposer would be making a major investment in extra STS fleet capacity and should have the potential for an appropriate profit over the lifetime of the investment. However, this appropriate return-on-investment must also not add to the price-burden for Shuttle customers so that they seek alternate launches and eventually drive up the price to both Government and private users due to significant decreases in launch rates;

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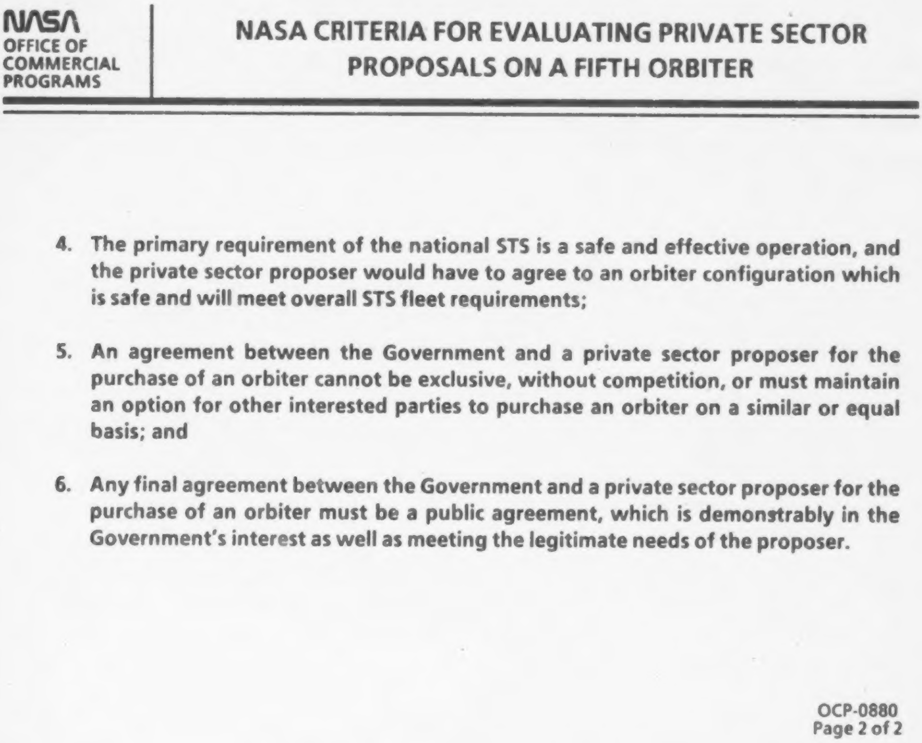
FIGURE 1

As you can see, these criteria are very general in nature, but they outline a set of principles on which we thought we could form a basis of discussion with the private sector. There tried to be balance, in particular the second principle. That seems to be the principle wherein we have had the most difficulty, and I think I might summarize the proposals in saying that it is in meeting the second proposal that we ran into the greatest—that second criteria that we ran into our greatest difficulty. That's the risk-sharing concept as Dr. Graham in his testimony the other week said that we could not reach agreement on an appropriate sharing of risk.

The next Vu-Graph (fig. 2) simply continues these principles, and these principles as I said have been applied to what we've done in dealing with the private sector for an Orbiter. These principles were included in our announcement in Commerce Business Daily that requests expressions of interest—that you mentioned in your earlier discussion—which closed on the 28th of February. At that time we had received four expressions of interest.



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4. The primary requirement of the national STS is a safe and effective operation, and the private sector proposer would have to agree to an orbiter configuration which is safe and will meet overall STS fleet requirements;

5. An agreement between the Government and a private sector proposer for the purchase of an orbiter cannot be exclusive, without competition, or must maintain an option for other interested parties to purchase an orbiter on a similar or equal basis; and

6. Any final agreement between the Government and a private sector proposer for the purchase of an orbiter must be a public agreement, which is demonstrably in the Government's interest as well as meeting the legitimate needs of the proposer.

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FIGURE 2

I would like to list the companies that responded to that proposal. They were first of all Astrotech; secondly, Captronics Manufacturing, Inc.—it's a small, privately owned high-tech manufacturing company in Dallas, TX; Independent Business Consultants, that says that it represents a number of large firms who would like to propose—pool their funding for the purchase of an Orbiter—that's from Stoughton, Wisconsin; and finally, Batten Heads, Inc.—it's a manufacturing company in Romulus, MI. We received those four responses to our REI's, and what we're in the process of doing is drafting a RFP to be sent out to these and other interested parties. That would be the next step, a formal request for proposals, and we would evaluate those proposals in accordance with the normal selection processes that are used in Government procurement processes, and that is where we are, Mr. Chairman, and that's where we've been in this matter.

[The prepared statement of Isaac T. Gillam IV follows:]

National Aeronautics and
Space Administration

Hold for Release Until
Presented by Witness

March 19, 1986

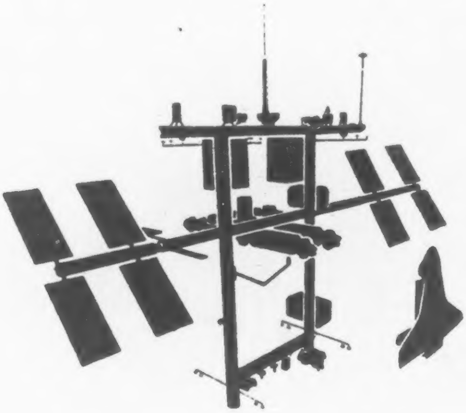
Subcommittee on Space Science and Applications

Committee on Science and Technology

U. S. House of Representatives

Statement by:

Isaac T. Gillam IV
Assistant Administrator
for Commercial Programs



99th Congress

Hold for Release until
presented by witness on
March 19, 1986

Statement of

Isaac T. Gillam IV
Assistant Administrator
Office of Commercial Programs
National Aeronautics and Space Administration

before the

Subcommittee on Space Science and Applications
Committee on Science and Technology
House of Representatives

Mr. Chairman and Distinguished Members of the Subcommittee:

I appreciate the opportunity to appear before the subcommittee today to discuss NASA's experience with private sector proposals for the procurement of a Space Shuttle orbiter. President Reagan, in his National Space Policy of July 4, 1982, made the expansion of private investment and involvement in space a major objective of the United States. A potential area of private investment is in space infrastructure which includes additional fleet capacity.

Two proposals for private investment in Shuttle fleet capacity have been given serious consideration by NASA: one from the Space Transportation Company (STC) in February 1982 and the other from Astrotech International Corporation in 1984.

Upon receipt of the first proposal in 1982, NASA formulated guidelines which would serve as a basis for evaluating such proposals. These guidelines were:

a. Any agreement between the Government and a private sector proposer to purchase an orbiter must provide for the exercise of national security, rescue, or NASA priority missions;

b. The Government has made a major investment in the STS and the terms and conditions must appropriately recognize the investment and must contain methods by which the Government gains as each party shares appropriately in the risks associated with operations;

c. The private sector proposer would be making a major investment in extra STS fleet capacity and should have the potential for an appropriate profit over the lifetime of the investment. However, this appropriate return-on-investment must also not add to the price burden for Shuttle customers so that they seek alternate launches and eventually drive up the price to both Government and private users due to significant decreases in launch rates.

d. The prime requirement of the national STS is a safe and effective operation, and the private sector proposer would have to agree to an orbiter configuration which is safe and will meet overall STS fleet requirements;

e. An agreement between the Government and a private sector proposer for the purchase of an orbiter cannot be exclusive, without competition; or must maintain an option for other interested parties to purchase an orbiter on a similar or equal basis; and

f. Any final agreement between the Government and a private sector proposer for the purchase of an orbiter must be a public agreement, which is demonstrably in the Government's interest as well as meeting the legitimate needs of the proposer.

These guidelines have been used in previous NASA testimony on this subject and have been incorporated into the record.

Space Transportation Company (STC), a Princeton-based firm which has since gone out of existence, sought exclusive rights to commercial and foreign space market for the Shuttle fleet in exchange for a $1 billion investment in a fifth orbiter. The Astrotech International Corp., and its subsidiary the Space Shuttle of America Corp., proposed making a $2 billion investment in the fixed assets of the Space Transportation System in exchange for 40 percent of the total (Government and civil) revenues from the fleet.

No agreement was reached with either STC or Astrotech because the proposals failed to conform to the guidelines.

In order to determine the current level of interest in the private sector for this kind of venture, NASA initiated a Request for Expressions of Interest (REI). This REI appeared in the Commerce Business Daily on January 22, 1986, and incorporated the guidelines outlined above.

Four expressions of interest, including one from Astrotech International's subsidiary General Space Corporation, were received before the February 28, 1986, deadline. No further expressions of interest have been received. Action on a potential Request for Proposals for a commercial orbiter awaits definitization of NASA's plan for recovering from the Challenger loss.

I will be happy to answer any questions you may have.

Gilliam

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Mr. **Nelson**. Could somebody turn on the lights for us, please? When will that request for proposal go out?

Mr. **Gillam**. We haven't set a specific date for it. We have formed a team. The team is a typical NASA-type team that has evaluated the previous proposals with representatives from the Office of Procurement, representatives from general counsel's office, the Office of Space Flight, our office, the Comptroller's office, and they will prepare the RFP. We have some concepts under consideration, they will evaluate these various concepts, and employing the criteria that we have, get the RFP out. The team has not met yet. I would presume that we could have an RFP prepared in the next 60 days or so.

Mr. **Nelson**. Then it's incorrect in the Wall Street Journal article that said that you had shelved the idea after the accident?

Mr. **Gillam**. That was a very incorrect item. There were a couple of items. We took some action in response to that. We contacted all four of the proposers, told them that that was incorrect. We wrote them a letter to that effect, and in doing so we found out that there was also an error in the article because the article states that one of the proposers said it was a joke. That proposer said no, it was not a joke, he was very serious. He was called at 4 o'clock in the morning, and when he picked up the phone he says is this a joke? And that's how that got into the article.

Mr. **Nelson**. Well, if I had a call at 4 o'clock in the morning, I'd say is it a joke, too.

Were those criteria, those six criteria that you showed there, were they ever the subject of public comment?

Mr. **Gillam**. No; we did not put—advertise them in the Federal Register. We did put them on the record here in the Congress at the time we were proposing that they be the criteria that we would evaluate the STC proposal. So they have been placed in the Congressional Record. The timeframe is approximately summer of 1982.

Mr. **Nelson**. All right.

Mr. **Gillam**. General Abrahamson's testimony.

Mr. **Nelson**. Excuse me?

Mr. **Gillam**. In General Abrahamson's testimony in mid-1982.

Mr. **Nelson**. All right. Mr. Rockwell, what kind of long-term lease arrangement do you propose?

Mr. **Rockwell**. It'd be a form of sale and leaseback based on a 15-year lease. Now the details would have to be negotiated and our underwriters in New York would have to be involved in those negotiations. So I can't tell you exactly what the terms are that they're going to require, but they say with a proper Government lease, and there's precedents for this in the Government, that they could easily raise the funds to carry out this transaction.

Mr. **Nelson**. The Government would own under your proposal the Orbiter, or you would own it and lease it to the Government?

Mr. **Rockwell**. They would sell the Orbiter to us, and we would lease back to the Government.

Mr. **Nelson**. All right. And so at the end of the lease it would be owned by whom?

Mr. ROCKWELL. That could be worked out so that it'd either be owned by us or it'd be owned by the Government on a—what do you call it?

Mr. GRIFFIN. Sale—lease to buy option.

Mr. ROCKWELL. Yeah, lease——

Mr. GRIFFIN. Lease to buy option.

Mr. ROCKWELL. Lease buy proposition.

Mr. NELSON. And what would be the number of years of the lease? You said 15 years?

Mr. ROCKWELL. Fifteen years.

Mr. NELSON. All right.

Mr. GRIFFIN. And if I might add here, Mr. Chairman, the idea would be to have the flat lease price so that you didn't have peaks in the funding that follow the typical procurement sort of curve would be just to let—an annual flat cost.

Mr. NELSON. All right. Now what percentage of the total commercial market or the total shuttle revenue pool would your proposal seek to have?

Mr. ROCKWELL. None. You might be misled by a story that appeared in the New York—in the Wall Street Journal——

Mr. NELSON. That's what——

Mr. ROCKWELL [continuing]. Which outlined some of the proposals—some of the discussions we had with Ike Gillam about 2 years ago where there was a sharing of the revenue with the Government. Is that correct, Ike? [Mr. Gillam nods.]

And the reporter got confused and stated that that was the type of a lease we were talking about, but no, we are not talking about that, we are talking about a straight sale and lease and—spread over the life of the shuttle, which as you know is about 15 years.

Mr. NELSON. How would you expect to insure this investment?

Mr. ROCKWELL. We would be unable to insure it. Nobody in this country could insure it with today's insurance markets, as I'm sure you're—which I'm sure you're aware of. The total market for space is about $600 million, and the total market for hull insurance is around I think a total of $150 million. We would propose, however, that we would—we are—in fact we are already setting up an offshore insurance company that would insure it to the extent that we could get coverage, and could get reinsurance in the world markets for insurance. And we—our underwriters estimate that over a period of about 5 years or maybe a few more we could build up enough funds that we might be able to ultimately fund the entire—the insurance on the entire shuttle.

Mr. NELSON. And up until such time as you might have a pool built up big enough to insure the vehicle, who would bear the loss in the case of either total or partial loss?

Mr. ROCKWELL. That would be the Government's, just as it is today.

Mr. NELSON. In the case where you—you say it would be the Government, and yet you would be the owner?

Mr. ROCKWELL. Yes, because it's a full, a full lease.

Mr. NELSON. Your propsal is that then at the end of the year if you had a total loss of the leased shuttle that then the Government would reimburse you for the total amount invested for the price of the Orbiter?

Mr. **Rockwell**. Yes,——

Mr. **Nelson**. Is that correct?

Mr. **Rockwell** [continuing]. They would reimburse the investors that had put the money into the shuttle, yes, and we—see, we would be placing debentures, selling debentures in the market using a combination of funding, but the—in order to sell debentures you have to have the full credit of the Government standing behind those debentures.

Mr. **Nelson**. In that case where the Government would in essence bear the entire financial risk in the case of loss or partial loss, which we certainly don't anticipate, but were that catastrophe to occur, what is the incentive then to the Government to, if it's bearing all the financial risks, to lease it from you?

Mr. **Rockwell**. I think the incentive is for the Government to spread the cost over a period of 15 years rather than having this problem that Gerry has mentioned so very capably of front-end loading or peak years.

Mr. **Nelson**. And what then would be the cost of the lease per year?

Mr. **Rockwell**. That I can't tell you. There are so many variables in it we don't know what kind of depreciation we'd be allowed, you know about the—you know the complications there with what is it, the Pickle Act?

Mr. **Nelson**. The R&D tax credit?

Mr. **Rockwell**. Beg pardon?

Mr. **Nelson**. The R&D tax credit, investment tax credit?

Mr. **Rockwell**. Is that what it is?

Mr. **Nelson**. Well, I'm not sure. What are you referring to?

Mr. **Rockwell**. It's the——

Mr. **Griffin**. I might be able to help a little.

Mr. **Rockwell**. Can you help, Larry?

Mr. **Griffin**. I think there's a precedent where some ships for the Navy in 1983 were purchased through a similar setup and there were tax advantages given to the investors in a later act, and I'm not sure what it's called. Some of those were reverted by the Congress, and I'm not quite sure——

Mr. **Nelson**. OK. Well, aside from various tax advantages which you would crank into your calculations, into your formulas, let's get basically what are we talking about in the cost of an Orbiter.

Mr. **Rockwell**. We will fund whatever the cost of an Orbiter is, $1.5 billion, $2 billion, whatever it is.

Mr. **Nelson**. All right; Then $1.5 billion, $2 billion. Let's take a round figure just for our purposes, $2 billion. All right? Would you propose that that be paid—you said earlier in your testimony on a straight, equal payment——

Mr. **Rockwell**. Right.

Mr. **Nelson** [continuing]. Over the life of the lease; is that correct?

Mr. **Rockwell**. Right.

Mr. **Nelson**. OK. So you are looking 15 years into $2 billion is something in excess of $1.3 million—$130 million——

Mr. **Rockwell**. Yes.

Mr. **Nelson** [continuing]. Per year.

Mr. **Griffin**. That's correct.

Mr. NELSON. All right. And then over—now that's base cost over and above that then you're talking about your interest on your investment.

Mr. ROCKWELL. Correct.

Mr. NELSON. Crank in your calculations on your tax advantages, and so forth. So what are you looking at, a cost upwards of $500, $600 million a year?

Mr. ROCKWELL. I don't think it'd be anything that high, but I—I cannot—I cannot nail those figures down.

Mr. NELSON. When do you——

Mr. ROCKWELL. It would depend entirely on the lease and depend on what our underwriter says he can do.

Mr. NELSON. When do you think you'll be able to nail those figures down?

Mr. ROCKWELL. It'll—it'll—it'll require negotiation with NASA for the lease, and our underwriter is prepared to come down and sit across the table from Ike and anybody else that's involved and work out the terms of the lease.

Mr. GILLAM. Mr. Chairman, I might add that some of the things that are being discussed and some of the things that have been discussed previously both with STC and with Astrotech are outside NASA's authority, NASA would have to come back to the Congress to get the authority to do some of the things such as the long-term commitment of Government funds, such as the insurance, and some of the other things that have been discussed. So in addition to negotiating with Astrotech, NASA would have to come back to the Congress for some authority.

Mr. NELSON. That's why I'm asking questions.

All right, now, would you propose any foreign investors, or just American investors?

Mr. ROCKWELL. I don't know, again, I'd have to talk to the underwriter as to whether he's going to raise this money in this country or abroad, but I suspect he can raise it in this country with a Government lease behind him.

Mr. NELSON. OK, then another question you've got to ask your underwriters then is how can you control who invests in a public offering? You said you were gonna have a combination of public and private offering for the debentures that you were going to offer.

Mr. ROCKWELL. Yes.

Mr. NELSON. So that's another question you need to raise with them. Now how much money have you raised today?

Mr. ROCKWELL. General Space has raised no money to date. General Space is being supported by Astrotech, its parent company. We made arrangements this week to go to market just as soon as we can get a prospectus out, but I'm not at liberty to dis—to disclose those figures. They are confidential within the company.

Mr. NELSON. And at some point in the future in your negotiation you will disclose some of those items of just what your financial viability is, I take it.

Mr. ROCKWELL. Yes, sir. Yes, sir.

Mr. NELSON. OK. What do you consider as you crank into your calculations—this is a private enterprise and it has to be profitable.

What will be your profit percentage that you will make as a proposal to NASA?

Mr. ROCKWELL. You mean on the lease? I don't think we're looking at any profit on the lease. We're looking at profits from other activities that will be in General Space such as our DARTS, such as the Leasecraft which we're negotiating with Fairchild, such as our orbiting power station we're working on with A.D. Little, these are other space activites other than strictly an orbiter.

Mr. NELSON. So you're looking to see a return on your investment of in our case of our example here, we said we didn't know the range, but we picked a number of $2 billion for purposes of our discussion. You're looking to a return on that investment from the additional services that you would sell from that investment.

Mr. ROCKWELL. Yes.

Mr. NELSON. Not—not in the lease to the Government.

Mr. ROCKWELL. Not in the lease; no, sir.

Mr. GRIFFIN. Can I interject something? I want to just make sure that you're—you're not coupling profit to return on investment, because there would obviously in the lease for the investors' purposes have to be some return—ROI on that investment, but it's not profit into the pocket of General Space in that case. The—and also, we haven't talked—and maybe you're gonna get to that later, you haven't talked about the marketing aspects that would be coupled with our proposal, which I think you'll probably want to discuss later.

Mr. NELSON. All right, Mr. Gillam, now in these criteria that you've set forth you point out that there has to be the national security or other priority missions that NASA would so deem. You point out the criteria that—that with the stake of the investment by the Government in the STS, which is what, in the range of $16 billion?

Mr. GILLAM. The last time I heard—the last time I looked at a runout figure it was in the neighborhood of about 14.5 real-year dollars.

Mr. NELSON. And you're saying that must contain methods by which the Government gains as each party shares appropriately in the risk.

Mr. GILLAM. Correct.

Mr. NELSON. In light of that 14 point what?

Mr. GILLAM. The investment, the last time I looked at the numbers was about $14½ billion, which does not incorporate the investment in the basic launch facilities that were built under Apollo, the VAB, which was built under the Apollo, and other facilities that were built for other NASA programs. The Shuttle Program itself, expenditures for that with the other things coming in as givens was about $14½ billion.

Mr. NELSON. OK. I wanted to depart here also now, is Mr. Heiss here? All right, if you'd come on up and let's have your comments, and then we'll dig into some additional questions, and I've been joined by my colleague, Mr. Walker, and we'll get him involved in the discussion as well. All right. Please proceed and don't read a prepared statement, just share with us.

STATEMENT OF KLAUS HEISS, ECON INC.

Mr. HEISS. All right. I've prepared a summary of the statement. First of all, to understand what decisions are necessary now, one has to revisit the history of the Space Shuttle Program and of private initiatives therein.

So first as to the 1972 space shuttle decision.

From 1970 to 1972 I directed the independent studies concerning the need for a new U.S. Space Transportation System under contract to NASA at the direction of the Office of Management and Budget.

Jointly with Wernher von Braun and Frank Borman I was the first to testify on the Space Shuttle before the U.S. Senate and before the House in 1970's. I've been closely associated with the Space Program in the past two decades, and in 1981 NASA awarded me the Public Service Award for outstanding contributions to the economic understandings of the space shuttle and the Space Program.

The 1972 Space Transportation Systems decision—consisting of the space shuttle and the space tug—was one of the most forward-looking technology enterprises of the United States—the only one in the 1970's. Yet, its implementation became seriously flawed:

One, the space tug was canceled. Three to five billion dollars of public funds were spent instead on "interim" solutions;

Two, NASA was held to an artificially invented budget ceiling in a period of rampant inflation, resulting in a myriad of technology development compromises;

Three, most fatal, in 1978 the continuity of production capability of any—of the only—future space transportation vehicle line was terminated with the cancellation of orbiter V procurement, leading directly to the current, predictable impasse;

Four, the private sector then proposed to offer the necessary funding for orbiter V in return for all non-U.S. Government marketing functions of the Shuttle System on a nonexclusive basis—this effort was started in 1979;

Next, the private sector also proposed and had negotiated with the Air Force, among others, the continuation at private expense of ELV production and launch operations as a backup to the space shuttle fleet. Had the private sector been allowed to proceed, the United States today would have:

(1) A brand-new orbiter V as of June 1986, for $1 billion paid by the private sector, and

(2) Four Titan 34-D's for use in 1986, again paid for by the private market.

Instead, the Nation today is faced with no space launch capability for large satellites for 1986 and possibly also 1987, including most important national security missions and a prospective bill of $3 to $5 billion, this time entirely at taxpayers' expense.

Before investing that type of money, whether public or private, into old Orbiter technology, I would propose:

(1) The private sector be finally allowed to take over the ELV launch business and all space marketing functions here and abroad, including the remaining Shuttle capabilities;

(2) The private sector do so with the right of additive cost access to all Government facilities and services: The private sector would reimburse Government only for the added funds needed—and proven to be needed—to accommodate such ELV activities;

(3) The current Orbiter fleet be frozen at three, in view of the ELV uses by the Department of Defense and the private sector—as well as the prospective space station capabilities;

(4) A block buy of new technology orbiters for the 1990's be initiated to indeed achieve low, reliable, and reusable U.S. space transportation capability, as originally promised in 1972;

(5) A reusable upper stage be developed, with private-sector participation, something much more important than one more orbiter of the current design; and

(6) The strategic defense initiative requirements should determine any additional space transportation technology needs beyond these immediate steps, including the potential promises of the aerospace plane.

A sizable investment by the private sector in the initiatives just outlined can be expected even now, if the private sector were only allowed and encouraged by Government agencies to do so.

One, last comment as to the 1982 proposal by SpaceTran to NASA and the Government. We did propose to share in the risk. What we did propose is to turn Orbiter V over to NASA operations and then share in the risk by being given 25 percent of the total fleet capacity, implying—and we discussed this with NASA—that if one Orbiter was lost, we would share to the same degree in the reduction in fleet capacity.

Two, the proposal, it's my impression, was rejected on item 2, namely "fair share." The summary of the evaluation by NASA to me and my associates was that it was "too good a deal for the private sector" to let it proceed along the lines proposed by us to the Government. I think today the investment indeed would have been one undertaken with extremely high risk even under the conditions proposed by us, and it would have been the ELV components that would have made the difference to the private venture and its profitability.

Thank you.

[The prepared statement of Klaus P. Heiss follows:]

A PERSPECTIVE ON PRIVATE INITIATIVES IN US SPACE TRANSPORTATION

Statement by

Klaus P. Heiss

to the

Subcommittee on Space Science and Applications

of the

Committee on Science and Technology

U.S. House of Representatives

Wednesday, March 19, 1986

Thank you, Mr. Chairman and members of this Committee, for giving me the opportunity - once more - to share my thoughts with you on matters relating to US Space transportation issues and private enterprise.

1. Background: The 1972 Space Shuttle Decision.

From 1970 to 1972 I directed the independent studies concerning the need for a new US Space Transportation System under contract to NASA at the direction of the Office of Management and Budget.

Jointly with Wernher von Braun and Frank Borman I was the first to testify on the Space Shuttle before the US Senate and House in the early 1970s. I have been closely associated with the Space program in the past two decades. In 1981 NASA awarded me the Public Service Award for outstanding contributions to the economic understanding of the Space Shuttle and the Space program.

The decision to proceed with the Space Shuttle (and the Space Tug - to make up the Space Transportation System, the STS) was made in 1972. It was based on extensive technical, economic, and effectiveness studies. The reasons to proceed with the Shuttle were NOT so much transportation cost savings - indeed they were estimated to be higher - but the ability to conduct Space missions in an entirely new mode, allowing for revisits, repairs, in orbit check-outs, and return of products, components, and entire satellites to Earth.

The Space Telescope is one prime example, and one of the few actually realized by NASA.

In a memorandum to the NASA administrator in October 1971 I concluded that a Space Shuttle of the current design ought to be developed - in preference to literally dozens of other competing ideas. This Shuttle should be assisted at take-off by either Solid Rocket Boosters or, alternatively, by equivalent liquid fuel pressure-fed boosters similar to the main propellant tank technology, the latter probably the preferred technology.

Part and parcel of that recommendation was also a reusable Space Tug to propel payloads from low Earth orbits to higher orbits and to retrieve payloads in the future.

The implementation of that original, forward-looking decision is by now a case history on how the best and most exciting technology programs can be made into a tedious hassle driven by budgetary 'concerns' that ultimately lead to economic and technical disaster. I believe the Space Shuttle development in the 1970s and 1980s to be a prime example of how the workings of the Government bureaucracy, the Executive Offices of the President (OMB, NSC) and the Congress can ruin a program that had every promise to advance the United States in Space for decades to come.

This 'Criticality' list includes:

(1) Choice of the Solid Rocket Boosters over pressure-fed liquid rockets to 'save' $500 million in R&D costs in the 1970s;

(2) The turndown of the European offer to develop the reusable Space Tug to complete the Space Transportation System. To date, after PAM-As, PAM-Ds, IUSs, TOSSs, Shuttle-Centaurs etc. (i.e. $3-5 billion), the United States still does not have a reusable Upper Stage, a critical item in the original Shuttle decision;

(3) The arbitrary $5.5 billion Shuttle development budget ceiling which ,under inflation, deteriorated into a development approach of 1970s 'savings' at the expense of 1980s operations and logistics.

The effects of this unrealistic attitude were many: foremost, instead of proceeding with a fully funded development effort, incorporating the latest and most reliable technology, all types of 'savings' were mandated in each and every system component of the Shuttle: engines were not tested to failure, computer systems on data handling were frozen, solid fuel rockets were preferred to liquid fuel rockets (see above), thermal protection tiles were preferred over metallic re-usable materials, and no adequate allowance was made for Shuttle operations issues (e.g. spare parts).

Corners were cut in every conceivable way just to achieve a 'first launch'. What suffered as a result were adaquate provisions for efficient, routine, low cost and safe Shuttle operations in the 1980s.

The most disastrous decision to the future of the Shuttle program was the cancellation of Orbiter V procurement in 1978.

2. Cancellation of Orbiter V: A Fatal Mistake in 1978.

With the advent of a new administration in 1977, the Space Shuttle program was one of the prime candidates subject to possible reduction, if not elimination. In the lengthy dispute - to early 1978 - a 'compromise' resulted: two launch sites (East coast and West coast), but only four Orbiters, INSTEAD OF A CONTINUITY OF ORBITER PRODUCTION or the minimum initial five units. This decision, though innocuous to the layman, was fatal to the effectiveness of the Shuttle program:

* With a discontinuation of Orbiter production the Shuttle system needed an EXPENDABLE BACKUP in the next two decades - through 1999 - by TITAN rockets, the Air Force system to deliver satellites to orbit. This conclusion was reached and stated to NASA and Congress in 1971 at the time of the original decision to proceed with the Shuttle, and implied an additional expenditure estimated then at about $2 billion. To this day I maintain that the decision to discontinue the Orbiter production line in 1978 was deliberate and taken with the full knowledge of the fatal implications it invariably would have on the Shuttle, US space transportation and national security.

The reasons for the need for continuity of Orbiter production in 1978 were:

* Only open production lines would ensure a continuous technology evolution of reusable Space Transportation systems, the Shuttle in particular, for the rest of this century. The US could not rely on only four vehicles of 1970s vintage for the rest of the century and NO OTHER SPACE TRANSPORTATION PRODUCTION CAPABILITY!

* Continuing Titan production lines - for backup in case the Shuttle vehicles were grounded - implied $2 billion or more in expenditures for the 1980s alone, A SUM MUCH BETTER SPENT TO PROCURE MORE AND IMPROVED ORBITERS - at that time at about $500 million apiece.

* Closing of the production lines also implied an inability to provide for an ADEQUATE SPARE PARTS policy at acceptable costs: since one did not know which 'parts' would be needed, either the full production capability would have to be maintained - without producing any Orbiters - or to forego certain production capabilities 'hoping for the best'.

In the end, NASA proceeded with procuring only four Orbiters and NO EXPENDABLE backup - the most costly and risky policy, now also proven to have been futile. All of this in the name of false 'economies'.

NASA CONTINUED THEN - AND SINCE - AS IF NOTHING HAD HAPPENED.

NASA SHOULD NEVER HAVE CONSENTED TO THE CANCELLATION OF ORBITER PRODUCTION LINES. NASA SHOULD HAVE TERMINATED THE SHUTTLE PROGRAM INSTEAD.

To me, the implications and the state of affairs were obvious - and I believe they were obvious to any halfway competent observer. I was so upset at the decision that I took a risky, unprecedented step to see to the private financing of the next - fifth Orbiter. Underlying this decision was a discussion I had with officials from OMB in early 1978 that showed no possible chance to reverse the decision to stop Orbiter procurements after four units.

3. The SpaceTran Proposal to fund Orbiter V: 1978-1983.

As stated above, I initiated, in 1978, the private funding of the Orbiter V unit, formed the Space Transportation Company Inc. ("SPACETRAN") in 1979, and by early 1982 obtained the participation of the Prudential Insurance Company to see to the financing of Orbiter V of up to $1 billion. The estimated cost - then - of an additional Orbiter was $960 million, as it took advantage of open production lines, since closed.

The proposal, formally presented to NASA in February 1982 and discussed before Congress in June of that same year, was straightforward. The key aspects of that proposal were:

(1) SpaceTran would fund a 'Carbon Copy' Orbiter V at a firm, fixed price of $1 billion;

(2) The US Government could add any improvements it deemed necessary for technology and national security reasons and be responsible for any costs in excess of $1 billion;

(3) SpaceTran would turn over Orbiter V at completion (June 1986) to NASA and in return would obtain the right to all revenues for Non-US Government uses of the Space Shuttle fleet up to about 25% of Shuttle fleet capacity;

(4) SpaceTran would reimburse NASA for launch costs incurred for the Non-US Government payloads under a 10 year agreement based on additive (incremental) cost prices fixed for this period;

(5) SpaceTran would recover its investment from any revenue above the incremental cost reimbursement to NASA.

4. Termination by NASA of Private Funding Initiative: 1982-1983.

The reaction of NASA was most curious: rather than jump at the opportunity of such financing and private initiative, the proposal was turned down by NASA - after year-long negotiations - BECAUSE THE PROPOSAL WAS TOO REWARDING TO THE PRIVATE SECTOR!

Throughout the negotiations for allowing such private funding the attitude by NASA officials was an ADVERSARY process, rather than one of cooperation to see how, jointly, one could bring about such an initiative, most important herein obtaining the consent of Congress. The record is devoid of any presentations by NASA to advance the private funding of Orbiter V.

In these adversary negotiations we even proposed to NASA that the private group would not have any exclusivity - i.e. if other groups in the future proposed to fund other orbiters, NASA was free to proceed. However, we needed NASA cooperation on 'additive launch cost', access to Kennedy Space Center launches similar to the understanding NASA had with the Air Force, and other usual business understandings, which NASA denied. End of venture.

ORBITER V WOULD HAVE BEEN COMPLETED IN JUNE, 1986, FOR A COST BORNE BY THE PRIVATE SECTOR OF $1 BILLION!

The 'public' reason given by NASA was that a fifth Orbiter was not needed since, with the HIGH LAUNCH RATES at East and West coasts, all foreseeable needs could be met. Of course, NASA knew of - but did not fight for - the need of Orbiter production continuity.

5. The SpaceTran initiative for Commercial Titans as a Backup to the Space Shuttle.

In the pursuit of the private funding of Orbiter V the financial markets in the private placement required of SPACETRAN a BACKUP for any non-US Government traffic in case the Space Shuttle were not available: We could not assure investors that the Orbiter(s) would always work and be available for non-US Government missions (i.e. pre-emption by military uses). And 'insurance' is inadequate compensation for business opportunities left stranded on the ground (see Intelsat VI in 1986 and 1987 with a $1 billion investment in 5 spacecraft).

To such purpose I negotiated and then signed, as President and CEO of SPACETRAN, an exclusive agreement with Martin Marietta, UTC and Aerojet on October 29, 1982, for all worldwide commercial uses of the TITAN family of launch vehicles. In return, we would proceed to procure 4 (four) TITAN 34-D vehicles by 1986 with the first unit to be delivered in March 1986(!). Jointly we would, and did, endeavor to obtain the necessary access to Air Force launch facilities at ETR (Cape Canaveral).

The proposal by SpaceTran to provide such commercial backup was again simple and straight forward: it was centered around the then competition for launches of the Intelsat VI series of spacecraft, starting in 1986, a $500 million opportunity with another potential follow-on market of maybe another $500 million.
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The SpaceTran proposal to Intelsat - and explored with NASA -

was:

(1) SpaceTran would contract with the suppliers a fixed, firm price delivery of four Titan 34-Ds with first delivery in March 1986;

(2) SpaceTran would provide the launch of two of the five Intelsat VI spacecraft in 1986 and 1987;

(3) SpaceTran would offer Intelsat backup launch options for the other three Intelsat VI spacecraft in case the Shuttle system was not available to Intelsat in 1986 and 1987;

(4) SpaceTran discussed with NASA the option to jointly propose a 'package' US launch offer consisting of three Shuttle launches and two Titan launches, so as to assure the United States of all of the five launches of Intelsat, i.e. the $500 million, thereby

(5) preclude foreign competition to gain a foothold for this series of launches, since Ariane IV was only to become available in 1987 at the earliest, i.e. the fourth and fifth contemplated Intelsat VI launches.

The proposal to Intelsat specifically pointed out that with the SpaceTran proposal Intelsat assured itself of the CERTAINTY of launches in 1986 and 1987, something that neither the Shuttle nor Ariane could provide to Intelsat.

We also pointed out that the $1 billion plus investment in the spacecraft was useless when on the ground and that the interest cost alone for a one year period exceeded $100 million. The revenue foregone probably amounted to two to three times that amount.

To NASA and the Air Force we pointed out that the nation would obtain and maintain a backup capability to the Shuttle at no added cost to the Government and that for national security reasons it was irresponsible to rely on one system and only four vehicles for the most important link in the 'Triad': the Space segment.

We negotiated with NASA from October 1982 to about May 1983 as well as with the Air Force in this matter. In addition to Prudential, Federal Express had taken a considerable interest in our expendable backup capability since, as a principal prospective user of large communication satellites, Federal Express was vitally interested in any backup capability to the Shuttle - just in case.

Things culminated in March-June 1983: we proceeded to offer TITAN launch vehicles to INTELSAT for launch assurance for large communication satellites - in competition against Ariane (!); we obtained insurance premium quotes from the market of about 5% (against 15% to 20% of Ariane); we even proposed to limit TITAN launch rates to 2 a year to accommodate NASA's stated fear

- to no avail. NASA did everything to have this private sector initiative stopped.

In our negotiations with the Air Force we found a most receptive and willing party. A Memorandum of Understanding (MOU) giving us access to Air Force launch sites on the East coast was drafted in conformity with DOD regulations and authority.

NASA made an all out effort to terminate any TITAN program with the Air Force and, indeed, intervened with the Air Force to have them not sign the needed launch site agreement with SpaceTran to proceed with commercial uses of the TITAN system by the private sector. NASA was fully successful in its intervention. No agreement was signed.

This intervention by NASA terminated any chances for efficient - or any - use of expendable backups for the Shuttle after 1985.

The 'logic' of the NASA reasoning was faulty then, and has proven disastrous now. NASA made presentations to us that a backup to the Shuttle was not in NASA's interest for the following reasons:

* If a backup system existed, the Shuttle program would be undermined in case of future difficulties or mishaps. Rather than see the Shuttle program thus diminished or endangered, NASA would ensure the continuation of the Shuttle program by a deliberate 'no choice' policy.

* Any US expendable launch activity would detract from Shuttle uses. Despite strong presentations to the contrary, NASA did not see that TITAN launch vehicles were actually competing against Ariane, another expendable vehicle of less proven launch record, rather than Shuttle launches. A case in point was the INTELSAT competition in 1983 where, indeed, the US would have won all five Intelsat VI launches (three Shuttle and two TITAN) had such an offer been accompanied by the requisite understanding with the US Air Force.

* If the private sector were to commercialize the TITAN system, the temptation of the Air Force to continue to make use of TITANs might prove irresistible.

At the bottom of this failure by NASA to perceive the national - rather than the agency - interest is what I call the 'ZERO SUM FALLACY', namely the notion that any launches gained by the private sector and ELVs are necessarily at the 'expense' of the Shuttle and NASA. The Intelsat VI outcome of the launch competition is a telling counterexample: the Expendables went to Europe and it now may well be that NASA may launch none of the Intelsat VI spacecraft. Loss to the United States in this one case: $500 million for sure, and maybe $1 billion in the longer term.

With the decision not to allow private funding of Orbiter V and the termination of the TITAN launchers in 1983 for last delivery in 1985 - the US was left with NO LAUNCH CAPABILITY FOR LARGE SATELLITES IN 1986 - AND ONWARD - SHOULD THE SHUTTLE FAIL OR NOT BE AVAILABLE FOR WHATEVER REASON.

After our presentations to the Air Force in 1983 as to the need for a commercial backup to the Shuttle, the Air Force revised their own thinking on the issue - and after a further yearlong study decided to proceed - against NASA wishes - with the procurement of TITAN 34-D-7s for 1988 onward at a rate of two per year as we proposed for commercial users, starting in 1986.

WITHOUT THE SHUTTLE, THE UNITED STATES IS LEFT WITH NO LAUNCH CAPABILITY IN 1986 AND 1987 FOR THE MOST CRITICAL MILITARY, SCIENTIFIC AND COMMERCIAL PAYLOADS. THE US HAS BEEN GROUNDED.

In conclusion, had NASA positively supported the directive of the President to see more private sector involvement in the US Space program and had NASA taken up the cause of these private initiatives in the 1980s - rather than do the exact opposite - and had Congress encouraged NASA in this course, the United States today - in 1986 would have

(1) A Fifth Orbiter being 'rolled out' in June 1986 for use by NASA at a cost borne by the private sector of $1 billion;

(2) ELV launch services to Intelsat with Titan 34-Ds, with several units 'in inventory' for use also by the Department of Defense, again all financed by the private sector and

(3) Have an active worldwide US Space transportation marketing organization competing vigorously - and fairly - with our friends in Space enterprise abroad.

Instead, the nation is faced with a $3 billion to $5 billion bill to be paid by taxpayers for promised future capabilities in 1989, and possibly later. It is time to let the private sector proceed and compete in the United States and abroad.

6. Outlook.

The implications of this history and the current situation in which the nation finds itself are quite serious. Everything has to be done to avoid the continuation of the current dilemma in the next decades.

6.1 Next Shuttle Launch.

The pressures will be extreme to have the next Shuttle launch occur as soon as possible, as if nothing had happened.

There is little doubt in my mind that the next Shuttle launch will indeed be successful, even if it occurs with no changes in procedures, design, and operations. BUT THIS IS NOT THE POINT: with no drastic changes in NASA policy, attitudes and de-facto backup possibilities, a climate of complacency and no-choice will again set in. The pressures to proceed with any given launch will once more increase, to maintain launch schedules of subsequent flights, to increase launch rate, etc.

NO NEW SHUTTLE LAUNCHES SHOULD BE APPROVED until a thorough re-evaluation of launch procedures, data flows and evaluations, as well as necessary hardware and software changes, have been implemented and tested. This may take from 12 months to two years. So be it.

The only Shuttle flights to be allowed before then should be strictly for the HIGHEST PRIORITY NATIONAL SECURITY MISSIONS without which US security would be severely and irreparably damaged. Nothing else would justify risking ONE THIRD of the remaining US Space transportation capability in 1986 and 1987 until the TITAN 34-D-7s become available in 1988.

6.2 Old Technology vs. New Technology Orbiters.

Do not throw good money after old technology Orbiters.

NO NEW ORBITERS OF THE CURRENT TECHNOLOGY AND DESIGN SHOULD BE PROCURED.

The need and chance for additional orbiter buys was terminated in 1982, when NASA decided not to allow the funding of Orbiter V by the private sector. That acquisition could have been done for $1 billion. To spend $3 billion or more today for early 1970s technology is wasteful and unwarranted.

Rather, NASA should evaluate the acquisition of an entirely new set of orbiters - a block buy - and incorporate in those vehicles all the technological and operational lessons learned. Doing away with the Solid Rocket Boosters may also be advisable.

6.3 Use Current Orbiters for Manned Spaceflight, Space Station, Shuttle-unique Payloads and Backup for ELVs.

The Space Shuttle has been a magnificent achievement ruined by NASA management and policy, with the help of OMB and Congress. There is no way now to make the current set of Shuttles into an economically viable Space transportation system for the rest of this century.

To appreciate this, one need only take into account the incredibly complex launch procedures and check-out requirements of the current system. The pressure of launch rate build-up and launch schedule requirements should be removed so as to give NASA time for appropriate assessment of the safety of any one MANNED flight. The launches of the current system will never be routine, and should never have been so.

Totally overlooked by NASA and Congress is the fact that with a US Space Station and ELVs the need for ADDITIONAL orbiters in the

1990s beyond the three Orbiter fleet is non-existent: with the Space Station as a transportation node, ELVs can fulfill many requirements which to date had to be fulfilled by the Shuttle. The United States should not buy the same promises twice: Payload missions made possible by the Shuttle, and Payload missions made possible by the Station greatly overlap. These missions include checkout in orbit, assembly of structures, refuelling and refurbishment, materials processing, and manned Space activities.

WHAT IS NEEDED IS A SPACE TUG (OTV, OMV, Reusable upper stage) with the Space Shuttle and the Space Station.

The argument that the US now needs an additional Orbiter of the same design for $3 billion plus 'in case we lose another one' is nonsense: the last thing the US needs is another old technology Orbiter, particularly if we should lose another one - since then the current design may well be unworkable.

Hence, the current Shuttles should be set aside for MANNED space flight requirements, launch of SHUTTLE-UNIQUE PAYLOADS, such as the Space Telescope, and later the support of the SPACE STATION, and be used for military and commercial flights only on a basis of free choice by the Air Force and the commercial sector.

6.4 Commercialize ELVs by the Private Sector with Additive Cost Access to Government Facilities and Services.

There is now no choice but to see to the quickest possible re-activation of an expendable launch system to complement the Space Shuttle. Without prejudice to any other option, the only system currently available to the US to fulfill this role across the board, and economically, is the TITAN family of launchers already under renewed procurement by the Air Force. It would make little sense to revive at Government expense additional old launchers, or to invent new ones, thereby delaying what should have been done two to three years ago.

This further means that, in addition to the Air Force, the commercial sector be given such a US choice, rather than be forced to use foreign launch systems: at this moment the only choice. For some payloads there is no choice at all until 1988 - the advent of the TITAN 34-D-7. Since the Air Force is already opening TITAN production lines, the private sector ought to be allowed to avail itself of the same system at ADDITIVE COSTS for the rest of this decade and into the 1990s. Production rates of TITANs can easily be increased to meet any and all national security and commercial launch needs of this nation well into the next decade.

In addition, of course, many other US expendable systems exist and should be 'allowed' to compete under the same groundrules. In fact industry should have an unrestricted right to do so. This includes Delta, Atlas-Centaur, Scout and several other new ELV vehicles. Some of these systems can fulfill launch services for payloads smaller than the Shuttle or Titan 34-Ds.

What is not needed is NASA inventing new ELVs at taxpayers expense and thereby preventing the commercialization of very efficient, proven and reliable US rocket technology: if it works don't fix it.

As to Space transportation needs in the 1990s - beyond a block buy of New Technology Orbiters and commercial ELVs - the requirements of the Strategic Defense Initiative will determine the architecture and mix of US Space transportation systems, including the potential promise of the Aerospace Plane.

It is my firm opinion that only this set of actions will suffice, given the situation in which the United States finds itself.

These actions have to be taken immediately, whatever the objections of NASA. NASA simply has no credibility left on this issue. Every day lost on this issue is a day lost in doing what has to be done anyhow. Every day lost on this issue means revenues and jobs lost by the United States to international competition.

These actions will also give NASA time and latitude to proceed with manned Space launches without undue 'pressure' from supposed competition from abroad - and the nation will do so economically and safely.

7. Summary.

The 1972 Space Transportation Systems decision - consisting of the Space Shuttle and the Space Tug - was one of the most forward-looking technology enterprise decisions of the United States - the only one of the 1970s.

The implementation of that decision must stand as a prime example on how not to manage the Nation's business, the failings of the Government bureaucracy, the Executive Offices (OMB, NSC), and the Congress:

* the Space Tug was cancelled. $3 - 5 billion were spent instead on 'interim' solutions;

* NASA was held to an artificially invented budget ceiling in a period of rampant inflation, resulting in a myriad of technology development compromises;

* most fatal, in 1978 the continuity of production capability of the only future Space Transportation vehicle line was terminated with the cancellation of Orbiter V procurement, leading directly to the current, predictable impasse;

* the private sector then proposed to offer the necessary funding of Orbiter V - in return for all Non-US Government marketing functions of the Shuttle system on a non-exclusive

basis;

* the private sector also proposed - and had negotiated with the Air Force among others - the continuation, at private expense, of ELV production and launch operations as a backup to the Space Shuttle fleet;

* both of these initiatives were opposed by NASA and ultimately brought to failure by NASA intervention with other Government agencies to prevent the requisite understandings with regard to Space launch and production facilities;

* this occurred despite the President's stated directive to see to the expanded private sector involvement in the Nation's Space business.

Had the private sector been allowed to proceed, the United States would have

(1) a brand new Orbiter V as of June 1986, for $1 billion paid for by the private sector and

(2) four Titan 34-Ds for use in 1986, again paid for by the private market.

Instead, the Nation today is faced with no Space launch capability for large satellites for 1986 and possibly also 1987 - including most important national security missions and a prospective bill of $3 to 5 billion, this time entirely at taxpayers' expense.

Before investing that type of money into old Orbiter technology it is proposed that

(1) the private sector be finally allowed to take over the ELV launch business and all Space marketing functions here and abroad, including the remaining Shuttle capabilities;

(2) the private sector do so with the right of ADDITIVE cost access to all Government facilities and services: the private sector would reimburse Government only for the ADDED funds needed - and proven to be needed - to accommodate such ELV activities (i.e. at no added cost to the US taxpayers beyond what the Government would do anyhow);

(3) the current technology Orbiter fleet be frozen at three, in view of the ELV uses by the Department of Defense and the private sector - as well as the prospective Space Station capabilities;

(4) a block buy of NEW TECHNOLOGY ORBITERS for the 1990s be initiated to indeed achieve a low, reliable, and reusable United States Space transportation capability, as originally promised in 1972;

(5) a reusable Upper Stage be developed, with private sector

partecipation, something much more important than one more Orbiter of the current design and

(6) the Stratigic Defense Initiative requirements should determine any additional Space transportation technology needs beyond these immediate steps, including the potential promises of the Aerospace Plane.

A sizeable investment by the private sector in the initiatives just outlined can be expected even now, if the private sector were only allowed and encouraged by Government agencies to do so.

This, in sum, I believe would finally put the Nation 'back on track' for opening Space to free enterprise by all mankind.

Mr. Nelson. Dr. Heiss, what are your "new technology" Orbiters for the ninties?

Mr. Heiss. Well, in 1972 one choice recommended to NASA was for example instead of the solids to use pressure fed systems as an assist to the orbiter. That would have allowed the termination of the propulsion during launch just like a shuttle was terminated 1 second before ignition of solids in one of the incidents last year. That choice would have required 500 million in 1970 dollars, probably $1 to $1.5 billion of additional nonrecurring costs in the 1970's. Because of the budget constraints imposed on NASA by OMB, that choice was not taken. Other new technology items in the orbiter would not be so much on the outside of the shuttle, pretty much the same configuration, but for example to have efficient operations of the shuttle the engines should last for 50 flights as originally desired. Today they have to be refurbished, cannibalizing other engines, I don't know how often, but certainly not even approaching 10 flights an engine. Other items have to do with the data processing, the electronics, the computers on the shuttle, thermal protection. I'm not a technical expert, but the key is the next-generation shuttle should indeed be a reliable and low-cost operations system. The current system is not.

Mr. Nelson. So you're talking about additional orbiters for——

Mr. Heiss. New technology orbiters, not carbon copies of the current design.

Mr. Nelson. And you're talking about additional ELV's.

Mr. Heiss. Yes, and at additive-cost access to Government facilities.

Mr. Nelson. And it's your opinion that there's going to be enough business in the private sector for ELV's and new orbiters?

Mr. Heiss. In 1982, yes. Today the heart of the matter is what will be the launch rate and the launch cost after the Rogers Commission is done with the review of the current shuttle design. If you cannot launch more than 12 shuttles a year, the launch cost will be so exorbitant that I do not think if that is the case that you will see a private-sector investment on its own of $1 or $2 billion as proposed in 1982; you will see more a lease type of arrangement. With the uncertainty on the launch cost and turnaround times of the current fleet I do not think that the same proposal that was made to NASA in 1982 by us can be repeated today and find the investment funds in the market—which should give you the answer to whether it's a good idea.

Mr. Nelson. All right. Now I want to hear from Mr. Gillam. What's your comment as you look back on his 1982 proposal?

Mr. Gillam. I would have to say I don't believe that there's been—I haven't looked at it from the point of view of the impact of the *Challenger* accident, but in the absence of that I would have to say that, looking backward at the proposal, our conclusions would have to be roughly the same.

Mr. Nelson. All right, and——

Mr. Gillam [continuing]. Without considering the impact of the accident.

Mr. Nelson. Forget the accident. What is—what were your conclusions in 1982.

Mr. GILLAM. We word it quite differently. As Dr. Heiss words it, it was too good a deal for the private sector. I think our wording of that would be that his proposal involved no risk on the part of the private sector and that Government acted as guarantor against any possibilities of loss either of revenue or loss of anything on the part of his proposal.

Mr. NELSON. All right. Talk specifics. What—that's a conclusion. Give me the specifics.

Mr. GILLAM. It's difficult to give you specifics because a substantive part of the specific wording of his proposal was labeled "Proprietary" and is still so labeled, Mr. Chairman. It would be difficult to do that, but, for example, I think Dr. Heiss has publicly stated that one of the criteria—I'll give you a couple of specifics. He said that he would put up $1 billion. At that time the cost of an orbiter was $1.6 billion. A second specific is that he was requesting that he have right of first refusal to the entire commercial and foreign market. There are other specifics that he has mentioned along those lines. It was those kinds of things that gave us problems at that time.

Mr. NELSON. All right, what is your response to that, Dr. Heiss?

Mr. HEISS. The cost of the orbiter in 1982 was 960 million firm fixed price if it were a carbon copy of orbiter IV. The additional fundings were entirely due to national security requirements of that orbiter unit, and second also technology improvements that were considered on top of the carbon copy of orbiter IV. Our proposal was: we would fund the carbon copy—it was not the private sector's role to fund technology changes and improvements. That was the proposal at that time. Today you would find a carbon copy of orbiter IV probably would be around $1.5 billion; by the time you add all the bells and whistles and national security requirements you probably are talking about $2 billion. That's the difference, and that was discussed with NASA and understood by NASA and Rockwell International.

Second, as to exclusivity, yes, in the spring of 1982 we asked for exclusivity. But the negotiations went on right through 1982 and early 1983 and in our final offer to NASA we dropped exclusivity and we said we have no problem with exclusivity as long as another group comes and also funds an additional orbiter they also can fight for the same market. We did not want, however, the Government to compete against the private sector.

Mr. NELSON. Well, you can start to see, Mr. Rockwell, that there are an awful lot of things that are going to have to be talked about. Here's an example of discussions that took place which were terminated because of differences of opinion and so forth and so on and as you say the situation is complicated even more because you're not just dealing with one agency, you're going to be dealing with the Congress as well. Let me pull together a few other loose strings here and then I'll share with Mr. Barton and Mr. Walker and you all decide which one wants to go first. I don't know who.

I would like to get just a little bit better understanding here.

Mr. BARTON. Well, we Republicans——

Mr. NELSON. Just 1 second. Let me finish just a couple of these loose ends here, Mr. Barton.

Mr. Rockwell, what percent return on investment do you believe that will have to be included within this lease arrangement in order for you to be able to raise the money that you need in private investment?

Mr. **Rockwell**. That's something our investment underwriters would have to answer. I can't answer that.

Mr. **Nelson**. Well, is there anybody with you that can answer that question?

Mr. **Rockwell**. No, we can't answer that question now. We can't answer that question now, no.

Mr. **Nelson**. Would the Government be expected to guarantee a minimum return under your proposal?

Mr. **Griffin**. I think so.

Mr. **Nelson**. All right, I'm seeing these guys are shaking their head no, and I'm seeing Mr. Griffin shaking his head yes.

Mr. **Griffin**. Better listen to them.

Mr. **Rockwell**. You say no, Karl, Tom?

Not over and above the lease payments.

Mr. **Griffin**. Yes, but there is a lease price, it's fixed.

Mr. **Nelson**. You talking about a fixed lease price.

Mr. **Rockwell**. Right, yes, sir.

Mr. **Nelson**. Which has the built-in return on your investors' investment which you're not prepared to say at this point.

Mr. **Griffin**. Right.

Mr. **Rockwell**. Right.

Mr. **Nelson**. All right. Let's talk about your marketing proposal. Why don't you tell us something about that.

Mr. **Rockwell**. Jerry, do you want to——

Mr. **Griffin**. Yeah. The idea here is that with General Space capitalization that we would undertake a broad marketing effort aimed at enhancing the use of the shuttle by gathering up payloads that would fly and that we would have to work it and this would have to be carefully negotiated that our real profit to General Space would come from putting that capital at risk and then figuring out a formula or a means by which we would share in the results of that marketing effort. That one has not yet been figured out and obviously is going to have to be carefully negotiated. But the primary purpose, Mr. Chairman, is to get a marketing effort that frankly the Government is hamstrung to try to operate in the commercial sector.

I saw that throughout my career at NASA that we were really hard-pressed to do what I would call a top—top-notch job of commercial marketing, and I think the people there have done about as well and maybe even better that one—than you might expect living under the constraints that the public sector must do, so the idea here is to establish a marketing effort that would really be purely on a commercial basis and would be broad in range, international in scope.

Mr. **Nelson**. Well, do you propose that General Space be the sole marketing agent for the shuttle fleet?

Mr. **Griffin**. If selected through——

Mr. **Nelson**. For the entire fleet.

Mr. **Griffin**. Yes.

Mr. **Nelson**. Not just for one orbiter.

Mr. **Griffin**. Correct.

Mr. **Nelson**. All right.

Mr. **Rockwell**. Commercial

Mr. **Griffin**. Commercial-commercial customers. We are not——

Mr. **Nelson**. Commercial customers.

Mr. **Griffin**. Right.

Mr. **Nelson**. OK. And you're saying that NASA would not do any marketing with commercial or foreign users.

Mr. **Griffin**. Foreign users—I was with you until you said "foreign," because if there is a foreign governmental entity that must be dealt with, obviously then NASA is going to have to do that. If there is a purely commercial endeavor that we can through some process to determine does not have a governmental tie, then I think that would be something that's subject to this negotiation to see how we would work those.

Mr. **Nelson**. Suppose——

Mr. **Griffin**. Primarily aimed, though, Mr. Chairman, at clearly commercial endeavors, and we would not be interested in trying to get into foreign national kinds of nationalistic kinds of programs.

Mr. **Nelson**. OK. The use of the shuttle, there are basically three areas in the use of it. There's defense payloads, there's scientific payloads, and there're commercial payloads.

Mr. **Griffin**. Right.

Mr. **Nelson**. All right, now, help us understand if you're doing all the marketing for the third group of payloads, commercial, and suppose that something of enormous importance in the eyes of NASA and the Congress with regard to scientific payloads occurs, such that the priority is asserted with the scientific payloads to the detriment of the commercial payloads, what in your proposal does NASA have to do to hold you harmless when in fact the interest of the Nation as determined by NASA is served by flying the scientific payload instead of the commercial payload?

Mr. **Griffin**. Mr. Chairman, my take on that would be that it would be not much different than what we've got today, that is, that if there is a priority mission, a governmental mission that is necessary, then the commercial sector will have to recognize that in the contract, in the launch services agreement or whatever it's called by that time, those kinds of things will have to be written into the contract, and our marketing effort would have to understand that, we'd have to get that across to the customers, the commercial customers again here, and make sure that they understood it. I don't see that as being much different than what we've got today, the NASA headquarters people involved in the marketing effort have got to live with that same set of circumstances today.

Mr. **Nelson**. How would you be paid for your marketing efforts?

Mr. **Griffin**. Well, that's one I think we've got to talk about. I—that one's a little less clear to me, but let me say that our idea here is that we would be putting our money into it, and that amount is yet to be determined, although we've got some broad parameters that we won't discuss here today in mind. And the idea here is that we've got to measure somehow the results of the marketing effort on the commercial side and share somehow with the Government in that process, in that return, and I don't——

Mr. ROCKWELL. In the prepared statement it says that we propose that incentive payments will be made by NASA to General Space for the described marketing subject to the success of the marketing activities. NASA and General Space will share in the incremental dollar gain from the commercial marketing activities.

Mr. NELSON. So that's a payment over and above the flat fixed fee of the lease.

Mr. GRIFFIN. Correct.

Mr. ROCKWELL. Yes.

Mr. GRIFFIN. Correct.

Mr. WALKER. I don't think that's what you're saying, is it? In other words, you're going to share the incremental—whatever you sell as I understand it you're going to share in the incremental increase and both NASA and you will make some money out of it.

Mr. GRIFFIN. Correct.

Mr. ROCKWELL. That's right.

Mr. GRIFFIN. But it is an additional amount of money that would come to General Space, but it is added revenue—an added revenue stream which we are sharing in.

Mr. NELSON. All right, now I thought I understood you, but now I don't, so let's go back over that again. Go ahead, Mr. Griffin.

Mr. GRIFFIN. Well, the way I envision this, and please understand that this is not fully worked out, but if we can undertake an aggressive marketing campaign that pays off, then our return would be in that payoff. That's the hard part to measure yet, and we've got to do some innovative, I think, proposal work to NASA or to the Congress and we're going to have to probably have a set of negotiations to pin that down exactly how you do that, but I think there must be a way to get at that if we can figure out how to do it to return some profit to us for our investment in and our energies put into marketing the shuttle, when it pays off.

Mr. NELSON. And that would be a payment under the present discussion additional from the Government, you're not speaking of the added compensation from your particular commercial customers, you're talking about an additional payment from the Government.

Mr. ROCKWELL. Entirely separate.

Mr. GRIFFIN. I think the answer to that question is yes, but I'm not quite sure I understood. I believe the answer is yes.

Mr. NELSON. In addition to the fixed fee of the lease, you're saying that there would be an additional payment from the U.S. Government to you if you had——

Mr. GRIFFIN. Successful marketing effort.

Mr. NELSON [continuing]. Successful marketing.

Mr. GRIFFIN. To the degree we were successful.

Mr. NELSON. And it would be on an incentive thing that the more successful you became, the more——

Mr. GILLAM. I think I can clarify what he's saying. He's saying that the additional payment from the Government would come from the additional revenues the Government derives from the additional business that they would bring in.

Mr. GRIFFIN. Very good. Thank you.

Mr. NELSON. Let me ask you this. Mr. Rockwell, since you are not in a position to talk about the return on the investment at this point until you confer with your underwriters, answer this question: Why is it not in the interest of the Government just to go out and borrow the funds in order to construct this orbiter as opposed through this arrangement with you? Share that with us.

Mr. **Rockwell**. You could certainly do that, but we are saying that by tying the two together we think we can considerably improve the return to the Government.

Mr. **Nelson**. Because of the increased marketing?

Mr. **Rockwell**. Yes, sir.

Mr. **Nelson**. In other words, you'll be hustling business that you think that otherwise would not be hustled by NASA?

Mr. **Rockwell**. Yes, sir.

Mr. **Nelson**. That's what it boils down to?

Mr. **Rockwell**. Just about.

Mr. **Nelson**. All right, now let me ask you this. You know we've had—we've had the Acting Administrator of NASA come here and talk about a commercial ELV industry. We're talking about the future, we're concerned if we get a replacement for *Challenger*, will we have enough capacity to do all the things that we need to do for the future, and therefore that's why there's some additional talk about offloading some of the commercial satellites onto ELV's. So the question is, if you also out here have a private entrepreneurial group selling a launch capacity of an American ELV industry, are you going to have enough business to hustle?

Mr. **Rockwell**. We think we are. There's a lot more coming in future years in space than just launching. I said in my opening remarks you can launch with an ELV, but you can't retrieve, you can't maneuver in space, you can't pick up a space platform that's growing crystals or growing pharmaceuticals, so that those things have to be done by shuttle. That's the other reason that I am urging you to consider seriously a fifth orbiter.

Mr. Chairman, may I add too that—I may have said something earlier that misled you—our marketing proposal would include the marketing of both shuttle and ELV's. It is marketing commercial payloads for NASA. It's a total picture.

Mr. **Nelson**. Total ELV's and shuttle marketing.

Mr. **Griffin**. Right.

Mr. **Nelson**. All right, now what happens if you've got another ELV industry that's completely separate from your bailiwick?

Mr. **Griffin**. Well, obviously you're in competition with them.

Mr. **Nelson**. That's right. That's what I'm raising.

Mr. **Griffin**. Nothing wrong with that.

Mr. **Nelson**. All right, let me ask you this. Would you reimburse NASA for repair, maintenance, and other launch cost?

Mr. **Rockwell**. No, the entire cost would have to be shared—would have to be that of NASA.

Mr. **Nelson**. Repair, maintenance, as well as launch cost would be borne by NASA?

Mr. **Rockwell**. Yes, sir, all the costs would be borne——

Mr. **Nelson**. The launch cost as well.

Mr. **Rockwell**. Yes, sir.

Mr. **Nelson**. OK.

Mr. Barton.

Mr. BARTON. Thank you, Mr. Chairman, you've done such a good job of asking questions, you've asked most of the ones that I was going to ask, but I am going to elaborate a little bit. First of all I want to commend you for holding this hearing. I happen to be one of the strong advocates that we should privatize a fourth orbiter if that becomes a policy that we need an additional orbiter. I commend you gentlemen from the private sector by stepping forward to take a swing at it. I'm not so sure that you've given us your best shot today based on what I've seen in the written testimony, and I would encourage especially you, Mr. Rockwell, if you expect the Congress, at least this subcommittee, to view it seriously, you're going to have to sit down with the chairman and the ranking minority and go into a little more detail. We can't make national policy decisions on just kind of a warm fuzzy feeling that that's—without being derogatory, that's basically what you've given us today.

A question that I have for Mr. Gillam, the last sentence in your prepared testimony, other than I'll be happy to answer any questions, is, "Action on a potential request for proposals for a commercial orbiter awaits definitization of NASA's plan for recovering from the *Challenger* loss."

I would hope that part of that definition process would include a consideration of private-sector participation in any replacement for the orbiter; at least it should be considered in that process. Would you elaborate on that a little bit?

Mr. GILLAM. It is already being considered in that process and during the course of the discussions that we've had with Mr. Rockwell, for example. We have said that any requests, for a supplemental, probably should incorporate a buyout provision which would allow the private sector, if we've reached agreement, to buy out the Government's investment in that supplemental. We're also, since that testimony was written—it was written to be given on March 6 originally and it has not been updated—since that time we have started to work in parallel with the recovery team on a request for proposals.

Mr. BARTON. OK.

Mr. GILLAM. So that that will be ready when the recovery team decisions are made and it will be ready to go out on the street.

Mr. BARTON. OK. I want to commend you, Mr. Gillam, and the other folks at NASA. The criteria that were developed I guess in the late seventies or early eighties, for privatization are—appear to me to be excellent, and I hope that they'll be utilized in this effort.

Mr. Rockwell, a question for you. The number that we've been throwing around about the cost of an additional orbiter is $2 billion. Now I am being led to believe that that cost may actually be significantly higher, in the neighborhood potentially of $5 billion. Now our committee chairman—subcommittee chairman may have additional information, but I read somewhere that Mr. Graham in testimony indicated that the cost may be substantially above that. If that's the case, and I don't know that it is, but if it is, how high is the private sector or your company in particular willing to go, 2 billion, 3 billion, 4 billion, how high before you decide it's not worth the effort?

Mr. **Rockwell**. If I may respond to that by saying we're ready to go to any reasonable figure, but let me add that I negotiated the contract to build the first orbiter, and the cost was about a billion dollars, and I think your average cost on your four orbiters is about a billion two or a billion three, so that when you start talking $3 or $4 or $5 billion, you need to take a good look at your contract.

Mr. **Barton**. Well I haven't seen the estimates, I'm just goin' from what I read in the Washington Post, basically.

Mr. **Nelson**. Would the gentleman yield?

Mr. **Barton**. Be happy to yield.

Mr. **Nelson**. Best I can understand from Dr. Graham, we're lookin' at about 1.9 billion for an equipped orbiter with engines.

Mr. **Barton**. Well where does this $5 billion?

Mr. **Nelson**. Well, you heard a figure of maybe a package for having assured access to space that not only included all of the equipment upon *Challenger*, which was a TDRSS satellite, remote—the arm, remote manipulator system, cradles that were in the cargo bay, the spacesuits that were on board, plus some ELV's that the Air Force was looking for to have assured access to space. That's where I think you heard that $5 billion figure.

Mr. **Barton**. OK.

Mr. **Gillam**. Mr. Chairman, in addition to all of that were all of the expenses associated with the recovery from the accident.

Mr. **Barton**. Well, I don't claim that I've seen a definitive breakdown of that number. I'd just heard some higher numbers.

Another question for Mr. Rockwell, I notice that Mr. Fletcher is on your board of directors. Since he's just been nominated to be the new Director of NASA, I assume that he will resign if that's—if you're—if we really get serious in discussions with your company.

Mr. **Rockwell**. Yes, sir, he has told me the day he is confirmed he will have to resign. Up until that day, I could keep him on my board of directors.

Mr. **Barton**. Well, I just wanted to see what discussions you'd had with him on that. Another question, and again this may show some ignorance on my part, but assuming that we do allow your company or another private-sector company to build a shuttle, maybe to operate it, do you provide your own astronauts, or does NASA provide the astronauts, how do we work that situation out?

Mr. **Rockwell**. No; our proposal is only to lease, to finance the Orbiter and lease it to NASA. NASA would continue to operate——

Mr. **Barton**. So NASA is still total—in total charge of the astronaut program?

Mr. **Rockwell**. Absolutely. Launching, astronauts.

Mr. **Barton**. OK. I guess one last question, and then I'll turn it over back to the chairman or to Mr. Walker. Dr. Heiss, in your testimony, you give in your summary three, four, and five, the current-technology orbiter fleet should be frozen at three, and then you say block buy of new technology—and of course Chairman Nelson had asked about that, and you really didn't give a very definitive answer on new technology. I happen to agree with three, that if we're gonna build a fourth we ought to go to new technology. Can you give—could you be able, or is somebody able to give a little better definition of what new technology you're looking at?

Mr. HEISS. Since I'm not NASA Administrator, I can answer quickly. I think what ought to be done is go out to industry and have them propose how they would build the next block buy of two or four orbiters and let them loose on proposing any improvement, state of the art, that can be done now with certainty that would be driven toward a low operations cost space shuttle fleet in the 1990's. I don't think it needs to take very long. I would be very surprised if what results from such a competition would be a carbon copy or anything even closely resembling, as to the heart of the technology, what the orbiter is today. There would be very important improvements in operations, I believe, from such a competition. I'm not talking about an entirely new vehicle, just make use of the experience and the lessons learned. Second, with regard to the capacity issue on the shuttle fleet, I do not know the results of the Rogers Commission, but it could well be that the safety of man on the shuttle may require from now on for some period of time very careful checkouts and it may well be that we will not be able to launch more than say one shuttle a month for a long time to come, say until the space station is available, and once we have the space station, you have to go back to the discussions of the late sixties. You see, the space station, with expendables—the lessons the Russians teach us today is that then—you can do most of the things you want to do in space with manned space flight even if you don't have the shuttle. I think we need a shuttle. I think we desperately need to learn from the current lessons, and we ought to go to two, four new orbiters. But let's have competition of ideas and then of those four, let the private sector fund again one. I would limit the investment to $1 billion. That's very fair considering the Government's investment, because the Government is here to help industry and the people to get into space, not the other way around. As to the principles laid down by NASA that you praised, since I was on the receiving end of those principles, No. 2, what does "fair share" mean?

Fair share means if I contribute $1 billion and have an expected return to that investment, that's fair.

If I take the risk of an orbiter loss with 20, 25 percent, I think that's fair.

Third, you cannot ask the private sector to be responsible for the loss, if I may go back to an earlier question, if NASA operates the system, as it should, because of manned space flight. Any private company who operates a system and then goes back to the producer because it ran "the truck" down the river would be laughed out of the room.

So you have to be very careful as to what the principles mean that NASA only elaborated in response to our proposal in 1982, not 1979.

Last but not least, let us not throw out necessarily the baby with the bath, or whichever sequence: The key opportunity before this country and Congress today is to create what the Europeans have done, a privately organized, commercially oriented entity that finally offers U.S. space transportation capabilities at a competitive price worldwide. We are not doing it, and NASA is not the entity to do it. They should do research.

This is the key opportunity and we should make use of people like Rockwell or others and let's concentrate on what has to be done in space transportation in the non-U.S. Government part, including shuttle's, including upper stages, including ELV's at additive-cost access rights. Never, never should a Government agency again ask the private sector for a fair share of what the Government has done in the past.

Mr. **Barton**. Well, I tend to agree with that. I look at this and I think the Congress looks at it from a little bit different perspective in that—in that at least I personally have a couple of goals. No. 1, I think the United States should maintain its technological lead in space. I think that should be a goal of whatever we do. A secondary goal is that the American taxpayer get the biggest buying for any tax dollars that are spent, and that's where I think the partnership between the private sector and the public sector can come in, and we're in the same ballpark now, we don't have an agreement but at least we've got some interest and I think NASA is willing to consider serious proposals, and if both sides will give, I think we'll come up with something that is good for the country and good for the taxpayer, and as I said earlier, Mr. Chairman, I'm glad to see this hearing, because this is right down the alley that I think we ought to be going, and would yield the balance of my time.

Mr. **Walker**. Thank you, Mr. Chairman.

I would also like to thank you for holding the hearings because I think that it's a very important aspect of assured access in the future. I think it's important to understand that what we're dealing with here is something very innovative, something very exciting, something new—in fact, something revolutionary because we're talking about doing something here that up until now NASA really has not ever seriously considered. There have been some negotiations but we have never really had a serious consideration in the kind of magnitude that we're now talking about.

I think part of the praise is the fact that we're—that we're here and able to talk about taking a revolutionary step is—can be credited to Ike Gillam, who went out before we even had the *Challenger* accident with the request to—to the private community to decide whether or not they ought to look into buying an orbiter. I personally want to say thank—thank you to him. I have done so privately before, but publicly I'd like to thank him because I think one reason why we have people sitting here with a serious—at least concept, if not a proposal, at least a serious concept is because you took that step in advance of the—of the orbiter accident.

Given the orbiter accident, though, we now find ourselves in a very, very tough situation in this Congress. We have limited amounts of resources for the future and those resources are not going to expand very markedly and we can talk all we want about massive supplementals around here or we can talk all we want about coming up with the kinds of bucks that are going to be necessary to buy a new orbiter, but it's going to be very, very difficult to get the votes to do it over any kind of a sustained period.

And so therefore, it—it—we need to look at some revolutionary steps in order to do all of the things that we want to do and do them at the best possible cost to the Government and in the best possible funding stream for the Government. It seems to me that

that's the opportunity that we get offered here because, with a lease-back arrangement, we will know what the fixed costs are to the Government over a period of time and my guess is that we will find that far more affordable than trying to find a couple of billion dollars right now to build a new orbiter.

And it seems to me that the idea of opening up to a new marketing arrangement that ends some of the Government redtape problems that are involved in any kind of a Government marketing program and is more innovative, is more entrepreneurial in aspect—probably increases the flow of revenue into the Government, is precisely the direction that we ought to look ahead as we try to figure out ways to—to get around it.

So let me deal with it from that aspect because I am very pleased that all of you are here because Dr. Heiss brought some of these ideas to Congress when he wasn't really being welcomed with open arms at NASA or even here in the Congress and he's been one of the people that has helped foster this kind of concept over the years.

The thing that I keep hearing all the way along is there's a great idea, wonderful concept, but nobody in the private sector is ever going to put up that kind of money for the orbiter.

Mr. Rockwell, it seems to me your testimony suggests that the potential for private funding is there. Would you elaborate?

Mr. ROCKWELL. Yes, sir. As I said earlier, we have a commitment from the leading underwriters in Wall Street. With a proper lease from the Government, they will raise the necessary funds for another orbiter.

Mr. WALKER. So it's really a policy question for us, and it's a policy question for Government. If Government is willing to make the right policy decisions with regard to assuring the private community that there is, in fact, a real cash-flow involved in this situation, the chances are that there—that the money can be made available to buy the orbiter with private funds. Excuse me?

Mr. ROCKWELL. Absolutely.

Mr. WALKER. So that the up-front money that we would need to buy a new orbiter would come out—would come out of private capital rather than us having to come up with taxpayers' funds at that point?

Mr. ROCKWELL. That's correct.

Mr. WALKER. And the—and what we would—what we would then do is we would have a leaseback arrangement, a payback arrangement for that investment having been made over a period of 15 years that would help you then recover that up-front investment that you've made.

Mr. ROCKWELL. That's correct.

Mr. WALKER. And beyond that, then, the profitability of your arrangement would rest in the fact that you would market the commercial sector activities of NASA in such a way hopefully to increase that private sector activity and thereby make a profit on the increased level of commercial loads that you're able to encourage into NASA. Is that—that's the agreement?

Mr. ROCKWELL. Yes, sir, that is correct.

Mr. **Walker**. Now we agree that that at the present time is conceptual in nature, that it needs to be fleshed out. How long would it take you to flesh out such a concept?

Mr. **Rockwell**. We have a tentative date, I think, for next week or the week after to sit down with Ike Gillam and possibly Dr. Graham to start fleshing these things out and our underwriter has said as soon as we can—as soon as we're ready to go—NASA's ready to go, they will come up from Washington, up from New York, and we'll sit down and tell exactly the terms that they need in order to raise the funds.

Mr. **Walker**. Let me ask Mr. Gillam. Mr. Gillam, do you have enough authority in your shop now without coming back to Congress to—to negotiate that kind of lease, do you think?

Mr. **Gillam**. No, sir. I stated earlier that some of the provisions that we've run into in our previous discussions are outside the authority of NASA, such as long-term multiyear commitment of the Congress. We don't have the authority to do that. Such as maybe some provisions associated with insurance.

We've got a pretty good idea of the areas that are fuzzy with respect to NASA's authority.

Mr. **Walker**. So what you're going to have to find out from them is kind of what they claim that they need; you're going to have to evaluate that and then probably come back up to us for some policy decisions that would allow you to move forward to negotiate that kind of lease if, in fact, that looks to be feasible.

Mr. **Gillam**. Correct. Both policy decisions and legislative authority.

Mr. **Walker**. All right.

Now, providing Congress were willing to go along with that and let's say the policy choices get made, we think we've got a pretty good concept in place, how long after that would it be until you could get an RFP on the streets?

Mr. **Gillam**. I think if we work parallel, we could probably have the RFP on the streets and have the responses back before we got——

Mr. **Walker**. So that—it would be basically a parallel arrangement. So that in large part, the timing on all of this is going to be up to Congress on how quickly we could react on policy-related decisions, is that basically the judgment at this——

Mr. **Gillam**. A combination of the Congress and the executive branch working together, sir, yes, sir.

Mr. **Walker**. OK. Let me ask you, Mr. Rockwell, or Mr. Griffin, what kind of interest rates are you looking at on your return on investment on the lease, on your lease arrangement? Do you have any?

Mr. **Rockwell**. They'd be—they'd be the very best rates in existence today, somewhere in the neighborhood of 7 percent, I believe.

Mr. **Walker**. OK, in other words, about Treasury—Treasury rates, is that what you're——

Mr. **Rockwell**. Prime Government obligations.

Mr. **Walker**. And you agree that other than the—than return on investment that would be built into the lease, all of your profit would be from the marketing arrangement. Is—is—is that—that's the kind of proposal that—that you're talking about bringing to NASA.

Mr. ROCKWELL. Sure.

Mr. WALKER. Thank you, Mr. Chairman.

Mr. NELSON. Mr. Gordon.

Mr. GORDON. No questions.

Mr. BARTON. Mr. Chairman, could I ask one more question?

Mr. NELSON. Sure.

Mr. BARTON. This is—this is just a question for my personal education. I'm fascinated by somebody like yourself who is willing to go out and to try to put this deal together. I come from Texas and we pride ourselves down there on being able to put together some pretty, shall we say, outlandish deals from time to time, but if I were an investor, potential investor, and you came into my office, what would you really use to try to sell me? I mean, we're looking at something that's never been done before. There's a lot of risk involved.

What would make me part with my hard-earned dollars to invest in this venture? What is your ace in the hole?

Mr. ROCKWELL. To invest in the lease of the orbiter?

Mr. BARTON. No, just to invest in your—you said you could raise $1 billion. You said no problem. Well, I'm your first contact and I've got the potential to give you $200 million if I believe in your idea.

What—what's going to sell me?

Mr. ROCKWELL. It's my underwriter that's going to raise those funds.

Mr. BARTON. Well, then, your underwriter—how's he going to sell?

Mr. ROCKWELL. He's going to come in here and say, look, I have got a lease from the U.S. Government that stands in back of this obligation.

Mr. BARTON. So just the fact that you've got a——

Mr. ROCKWELL. You have to say to yourself that's as good as a Government bond.

Mr. BARTON. The fact that the Government is behind you, then?

Mr. ROCKWELL. Yes, sir.

Mr. BARTON. And at a rate of return, whatever that magic number is, that he gets an equivalent rate of interest by investing with you instead of IBM or AT&T or something like that.

I just—I just——

Mr. ROCKWELL. He—he is investing only in the lease. He is investing only in the lease. He is not investing in General Space Corp. as a common stockholder.

Mr. BARTON. Oh, I see.

Mr. ROCKWELL. I've got a much better pitch on that.

Mr. BARTON. OK.

Mr. GILLAM. Mr. Barton, in addition to that, I know the Government doesn't know much about marketing, but I think if I was coming in to get you, in addition to what Mr. Rockwell said, I would hit you with things like world leadership, national pride, the national economic good and a lot of other things.

Mr. BARTON. That's true but that doesn't necessarily—if I'm a cold-hearted businessman——

Mr. Gillam. In addition to what Mr. Rockwell said, I would hit you with.

Mr. Barton. Thank you.

Mr. Nelson. OK. Let me try to pull together some comments before we get our panel of imminent financiers up here so that we can get your comments here. Just a few other additional details so that we'll have the scope of this.

Mr. Rockwell, what does your plan envision with regard to structural spare parts?

Mr. Rockwell. As I said, the operation of the orbiter is entirely in the hands of NASA.

Mr. Nelson. I'm sorry, I couldn't hear you.

Mr. Rockwell. Entirely undertaken by NASA.

Yes, Jerry might like to comment on that.

Mr. Griffin. Let me—obviously, the structural spares are a commitment already made. They are roughly 60 to 70 percent complete, I think the last time I looked in on them. I think it really is up to NASA whether to use—obviously to get the quickest orbiter, you'd use those structural spares to build the first one.

And then I think it's going to have to be determined whether you replace those structural spares or decide to go ahead without them. Now I think that's NASA's choice.

Our involvement, obviously, is going to be in terms of private-sector financing would be whatever amount it takes to complete that orbiter, and the sunk cost already—I guess that could be a subject of some negotiation, but the sunk costs already in those existing structural spares is not one that we have talked about assuming.

I think it—this brings a point up that I think needs to be made, and I can tell—I think I can speak for the other directors on Mr. Rockwell's board is that we all are very interested and see a need for the country to replace *Challenger*. In fact, there was a fair need for it before *Challenger* was lost.

Time is of the essence because I think we're going to start to fall behind and we may, to the point of nonrecovery if we wait too long. I would hope that there is some—something in this mechanism and I'm not quite sure what it is, between the public and private sector that we can start as soon as possible on building the team back and getting the capability back in the country to even build another orbiter. There is a lot—as you have brought up here with the structural spares question, we're not starting from zero. We've got a—we've got a head start on an orbiter build and I think it's important to get—to get the capability spun up as quickly as we can or we're really going to see a big gap in our capability.

I am still very, very concerned that when we do have a space station, which I think is going to revolutionize everything we've thought about in space up to now, that we have enough orbiter shuttle capacity to service it, and I think you've got to consider some of these things together.

The Congress, I think, should address the entire infrastructure that we're talking about servicing. We have Max Faget's Space Industries, Inc., endeavor. We've got the space station, and I think the need for the shuttle is going to be highly, highly raised within these next few years and I think for that reason, I sure would like to see if we can find some mechanism, irrespective of how we end up financing this orbiter, to get on with it and get started.

Mr. **Rockwell**. Amen, if I may say so.

Mr. **Nelson**. The nature of the genesis of my question is just what you underlined, Mr. Griffin, that if we're going to get about the task of building a replacement orbiter which I and you both feel is in the national interest, then we're in a fortunate position at least we've been keeping those lines open, however limping they may be, by having some structural spares.

So my—the nature of my question to you is projecting to the future, we've got to continue to have structural spare parts so there's nothing in your proposal that would—would make any reference to structural spares. That would be the responsibility of NASA in your proposal, is that correct?

Mr. **Griffin**. Well, I would say it in another way, to pick up on something that Mr. Rockwell said, is that I believe the investment community, if I read them correctly, and based on a relatively short time in dealing with this subject, are probably, if they are willing to finance at all a shuttle orbiter, a reasonable number is—is probably what is—is the final answer here and whether it is $1.5 billion added to the sunk cost in the structural spares or whether it is $2 billion, I am not sure whether that is a big issue or not. It may be, but I think that is kind of a—what I would put into terms of "to be determined" category.

Mr. **Nelson**. OK, let me go back. You had talked earlier about the marginal cost and—and I take it that you said your initiative would reimburse NASA for the marginal cost rather than the full operating cost for launch and flight operations; is that correct?

Mr. **Rockwell**. No, we—we will reimburse NASA for the entire cost of one orbiter.

Mr. **Nelson**. Nothing on the flight operations.

Mr. **Rockwell**. No, sir.

Mr. **Nelson**. Nothing with regard to——

Mr. **Rockwell**. We're leasing it to NASA. NASA's the one that's benefiting by the use of the orbiter. Right?

Mr. **Griffin**. We would market—we would market cargo at the going rate, if that makes any sense.

Mr. **Nelson**. All right. We've talked about the cost of a replacement orbiter. What would happen if you had schedule and cost overruns on building the new orbiter? How would your proposal accommodate this?

Mr. **Rockwell**. That would have to be part of our negotiations in the lease. Either we—we get a fixed price from NASA. They say we—we have, in fact, NASA should probably get an RFP from a contractor, one that I used to know probably, but a contractor, and we'd base the financing on that cost.

Mr. **Nelson**. So you're talking about a fixed cost regardless of the cost overruns which you would nail that down for which you would be responsible for under your proposal.

Mr. **Rockwell**. Unless there is some proviso that if there are overruns, then they should be—was increased.

Mr. **Nelson**. All right. What would you propose in the way of the Government incurring liability if, in fact, your venture were to fold?

Mr. **Rockwell**. I don't exactly follow you on that, but what—what we're talking about is—is a lease placing debentures or something—that isn't going to fold. It's still backed up by the Government. It only folds if the Government folds, correct.

Mr. **Griffin**. That's what it says, I think.

I think once the lease arrangement—the buy and lease arrangement is organized, it's done, and I don't think you're going to have any opportunity for folding other than the fact that I guess if you had a tremendous cost overrun that nobody could handle, you might declare it all null and void and—but that's not going to happen, not in this—in this timeframe.

Mr. **Nelson**. Would you require exclusive rights to negotiate with NASA before giving specific details regarding the terms and conditions of your initiative?

Mr. **Rockwell**. You're asking me? Would we—would we ask for exclusive rights?

Mr. **Nelson**. To negotiate with NASA. Are you going to—in other words, are you going to tell NASA that you've got to agree to exclusively negotiate with me before we give you the specifics of the terms and conditions of our proposal?

Mr. **Rockwell**. I'd like to get such an agreement out of NASA, but I'm not sure I could.

Mr. **Nelson**. All right, that's what I wanted to know.

What rights in the remainder of the STS fleet would you seek in the case that you had a temporary or permanent downtime of the privately funded orbiter?

Mr. **Rockwell**. That's not our business. Our business is merely a lease and the payment of the lease by the Government. There would be no provision if the thing didn't fly, the lease payments still go on.

Dr. **Heiss**. Could I try to paraphrase what I think is being proposed: the private sector would turn the orbiter over to NASA, it becomes an integral part of the national fleet, but in return for it, the private sector is simply asking, "look, let us now at least do the marketing to the commercial sector worldwide." That's it. The proposal of lease financing, I think, as long as it's done at a rate similar to how the Government could get financing, the private sector should get preference, just as a basic attitude.

The merits—the additional benefits to the Nation clearly stated a long time ago at that time is that—the private sector then has an incentive to go out worldwide and do what companies always were best able to do. It would be a commitment by this nation finally to have private sector involvement in space.

The last time this Nation took a courageous step in commercial uses was in 1962 when we formed the Communication Satellite Corp. The story in communications is so dramatically different in the success compared to now the history in space transportation, remote sensing and material processing. So I think the key advantage of what's being proposed here is such that, even if the cost to the Government were the same, you ought to give finally preference to the private sector to get involved in this way. It always has been around—the other way around.

Let me compliment Ike Gillam. He was the most benign, inspired and intelligent negotiator I ever had the pleasure to do business with, but he still has and is confined by the ground rules that were put on him and if you, for example, cannot have NASA take contingent liabilities in a commercial venture, the Government is an uncredible partner for commercialization. That's the issue.

So here, even if the numbers are 2 billion, even if it can be shown after negotiations that the cost to the Government is the same going privately or the Government, then—particularly then—the preference should be given to the private sector involvement and do it if necessary on a sole-source basis. Don't get involved in delays or compete it, but have it done in 30 days.

Don't drag it out again for a year because for every day lost, the Nation loses.

Mr. **Nelson**. Let's talk about setting your price. How would you propose to set your price for your commercial customers?

Mr. **Griffin**. You're talking payload price or cargo price?

Mr. **Nelson**. That's correct.

Mr. **Griffin**. My thought there—and we haven't done a great deal of discussion on it—is that I believe the—to use a word that is used to often—the funding algorithms, if you will, that NASA uses in terms of—based on length and weight and so forth, services required, is a good one. It has been tuned through the years as time's gone on. It's based on a—as I recall, I think a load factor of 75 percent as being a full load and so forth.

Without getting into a lot of detail, I don't see any reason to change that, but I would pick up something that Dr. Heiss mentioned and that is I have always thought that in the long haul, we ultimately should get this system to an additive cost basis for determining the commercial prices.

And that's been a debate that has raced through the halls of Congress and the OMB and others for a long time. I would hope that we would get the price for commercial customers as low as possible within a sound fiscal policy for the United States so that we could, indeed, compete on an international basis and probably grab most of what is available.

If we take a full-price option where you take total cost of all of the—of the entire price of the shuttle operation and divide it by the number of flights per year, that gets to be an awfully large number, but we built the shuttle as an instrument of national policy and it was never intended to be fully recouped in cost by commercial users.

So I really think the additive costs or marginal costs—and I realize there's a slight difference there, but close—is the way to price the shuttle. Then once you've done that, determining how you break up the cargo bay and price the individual elements, I think the NASA formulas work very well and they're good ones.

So I would think we would just work some—some version of that.

Dr. **Heiss**. Could I suggest, without fee, that part and parcel of a 15-year agreement ought to be a 15-year agreement on what the price is that NASA will charge for this private entity to market the shuttle capabilities. The reason why I state it is I do think I was the first one called in by NASA in the mid-1970's to figure out how pricing ought to be done. You cannot have the private sector live with the uncertainty of pricing from year to year.

So part of the lease arrangement, financing arrangement, if there is a privately funded orbiter V or any orbiter V, ought to be a 10- to 15-year agreement based on additive costs as best as one can estimate them—and one can do a very good job—and then this becomes the firm, fixed price for the next 15 years because you cannot ask the private sector, you cannot ask U.S. space industry and you cannot ask the national space interests to live with the uncertainties that will continue to exist in operations of shuttle. Safety should not be sacrificed in order to drive costs down. Then you separate these issues, by finally doing an additive cost price for the shuttle for marketing for the next 15 years.

That should go and be combined with the lease arrangement and again, of necessary sole source: All the capable people have proposed—there are no more capable people around—get it done.

Mr. **Gillam**. Mr. Chairman——

Mr. **Nelson**. OK, just one second. Let me ask—go ahead, Mr. Gillam.

Mr. **Gillam**. What I was going to say was that this is not a NASA position. It is not necessarily my position. I am not necessarily for or against marginal cost pricing. I would just like to illuminate another side to the story.

The current price that is being charged for the shuttle includes both the marginal costs and the contribution to the fixed operating base of the shuttle. Removing that contribution to the fixed operating base would result in increased costs to NASA. And so I just point that out from a slightly parochial point of view.

Mr. **Nelson**. All right.

Dr. Heiss, earlier this year, NASA put out a solicitation on private financing of the shuttle. Now you—they did not have such a solicitation back in 1982. Did you respond to the solicitation this year?

Dr. **Heiss**. Well, on the 1982 situation, we did present it to Congress and there were no secrets here. Some of the particulars are very similar to some of the items discussed today. It was not lease financing. That was the big difference.

I think in 1982, the private sector was willing to take risks—and here is a friendly disagreement—you know, we were taking all the risks we could possibly take, with what we proposed. So, item 2, I just think on this list we met.

But today, I would say the following: I do think that what Astrotech, General Space is proposing, that is doable. But for lease financing, you should not come to me.

If you want any other form of financing, I think applied today that is impossible on economic grounds. What was doable in 1982 is not doable today.

Mr. **Nelson**. So you did not respond to this solicitation.

Dr. **Heiss**. I did not respond because I think that Astrotech is doing a good job.

Mr. **Nelson**. You said that you're not involved in lease financing.

Dr. **Heiss**. No; I am not involved in lease financing.

Mr. **Nelson**. Dr. Heiss, help us with your ideas about the private investor. What is his incentive to invest if all the control in the operation remains in NASA? How is this attractive to investors?

Dr. HEISS. I think that again what's been proposed on orbiter V, the way I understand it now, it is lease financing: the investor there would look at the rate of return he can make on this investment as against Government bonds or other instruments that he can invest in.

So he will never come around to your question: "What do I get on top of that." I do think that in order to get private institutions or entities involved to even propose lease financing, it ought to be combined with marketing and here what I hear is being proposed is that the private investor investing in companies like General Space would get an additional return.

I don't see it—the willingness to invest—tied to orbiter V financing as now proposed in what we heard. But why should an investor invest in space anyhow other than communications satellites? I think there are two items that have to be met before you will see that on a significant basis by the U.S. industry:

One, there has to be an absolute legal right by the private sector of the United States of additive cost access, not just to the shuttle, but also to launch facilities for ELV's, to ELV production lines, to the space station and to any U.S. platform.

What I mean by that is that any recovery of any funds that already were spent by the Government are sunk and it's really the purpose—and the condition should be—to find out what would the private sector or industry do on its own if given access to what exists anyhow.

This space investment is not happening out on, you know, on the moon. This is happening in the United States. Now NASA may not get its "fair share" back, but that's tough luck. They should not ask for a "fair share" back, either for themselves or for the government. The fair share the Government takes is in the taxes paid on the success of the ventures.

Secondly, what's needed—again to see a significant investment by the United States industry, otherwise we will be outdone by the Europeans and the Japanese—is a second very item important. You have to restore full property rights to whatever the private sector does in space.

Today that's not the case. In remote sensing, private property rights to original space data have been legislated away.

On material processing, we do not have an additive cost policy and on the joint endeavor agreements, again and again, the Government asks for information made available to others under such agreements as a "fair share."

I think you have to revisit property rights if you want a significant commercial use of the space station or the space shuttle or any other U.S. space capabilities in the 1990's. The Europeans just formed in January 1986 the third entity, Intospace, which will concentrate on material processing in space. We don't have such entities here. We don't even know the ground rules of access.

Mr. NELSON. OK, Mr. Gillam, tax considerations. Have they been factored in as a cost to the Government?

Mr. GILLAM. In our analysis, they were. In our analysis of the proposals that were made previously to us, both proposals were quite liberal in providing us with their financial information.

I think Klaus' was about 4 inches thick, if I am not mistaken, and Astrotech gave us—and we reviewed both their considerations of taxes and other items. I might add, Mr. Chairman, that NASA doesn't have a reputation for doing a great job of analyzing financial material and so in the first case, we had—we paid Price-Waterhouse to review our analysis of the proposal and they reviewed the analysis and said that our analysis was extremely conservative.

Mr. **Nelson**. OK, on criteria number two. We talked about the $14½ billion development costs. Is that factored in in any way in your negotiations here?

Mr. **Gillam**. No, it was not. That is one of the things that—that we had to just pass up. The ratio of investment—the negotiations we were talking about—we're talking about ratioing benefits in terms of the orbiter fleet. It did not ratio in terms of the total investment.

Since you asked me earlier, I have thought of another problem that was associated with the first proposal that we received and we were operating at that time under the assumption that for 24 flights, four orbiters per year, the fifth orbiter would provide us the capability for another five flights.

Dr. Heiss' proposal was that he would contribute toward the orbiter. Our estimates were that we would have to spend another $500,000 to be able to get our capability up to the 30-flight level in terms of ground support equipment and those other kinds of things which was another one of the problem considerations that we had back then.

Mr. **Nelson**. Does the RFP that you're planning to send out include a competition for marketing the shuttle?

Mr. **Gillam**. It's not formulated. I can say in our conceptual work that we've done on it, it will not preclude it, it will ask for various innovative approaches and it will have the criteria by which different types of approaches could be compared with each other.

We're not going to ask for a single approach. We're not going to dictate to the private sector the ideas we want them to send back.

Mr. **Nelson**. All right, now, you know we've had some folks that've said that they don't think that this is—is a way to go. Last year, the Smylie Commission recommended against transfer of the shuttle management, including the marketing. This year, the National Academy of Public Administration recommended reorganization within NASA, of the STS management operation.

All right. Considering that as background, how is NASA going to proceed to receive these various proposals?

Mr. **Gillam**. Well, I think the proposals—from what I've been able to glean from the proposals that I've heard and from the discussions with Mr. Rockwell, I think the proposals that we're going to see are going to require that NASA continue as operator of the shuttle and that some arrangement be worked out between the private sector and NASA to accommodate the given that NASA will remain the operator of the shuttle and some reimbursement arrangement or some other type of arrangement will be worked out between the private sector entity and NASA to fairly balance out the responsibilities and the equity in terms of risk and responsibilities and rewards as indicated in our guidelines.

So I don't believe there is a proposal on the table for anyone from the outside to take over operation of the shuttle. That was what the Smylie committee addressed and that was what—the reorganization within NASA was concerned with—the internal NASA operations for managing and operating the shuttle.

Mr. **Nelson**. All right. So—I was momentarily distracted here. Let me ask this question: Are you considering a—a marketing plan along with the private financing plan or would you consider a market plan for the commercial payload separate and apart from any financing or will you consider all?

Mr. **Gillam**. We would consider all. Right now, I might tell you that we have within our planning a user development concept where we're considering going out with an RFP to hire the private sector to do the user development work in our commercial program area. We've combined with the Office of Space Station so that this will be a unified new user development process that is jointly done by the two offices. The marketing activities that are done by the Office of Space Flight are really focused on sales to the current market as opposed to the user development focus that the Space Station and our office have.

So I would have to—the response to the question is we would be willing to consider all approaches.

Mr. **Nelson**. OK.

Now, if I can ask you all just to slide down the table and if we can have the other gentlemen——

Mr. **Walker**. Just one question, if I could, of Mr. Gillam——

Mr. **Nelson**. Sure. They're not going anyplace.

Mr. **Walker** [continuing]. Mr. Gillam, but just a quick question. Based upon what you've heard here today, what your previous negotiations have been, can this thing be done, Mr. Rockwell?

Mr. **Rockwell**. I think it can.

Mr. **Walker**. Mr. Gillam.

Mr. **Gillam**. I think it's possible.

Mr. **Walker**. Thank you.

Mr. **Nelson**. All right, how about the gentlemen coming up for our panel.

Would you all like to proceed on the basis of the order, if that's all right, in which you appear on the witness list and may I recommend—Dr. Heiss, you have to catch an airplane, so take off.

Dr. **Heiss**. Thank you.

Mr. **Nelson**. How about let's proceeding with you. We don't want any lengthy read statement. If you'd just be concise, talk to us, and then we'll get into the questions.

So let's just start off in the order of the list.

Mr. Samuels.

STATEMENTS OF JAMES P. SAMUELS, SHEARSON-LEHMAN BROTHERS; JOHN S. BLIVEN, PRESIDENT, CENTER FOR FINANCE AND PRESIDENT, SPACE COMMERCE ROUNDTABLE FOUNDATION (FORMERLY SENIOR VICE PRESIDENT, BANKERS TRUST, AIRLINE, AEROSPACE AND AIRFRAME); JEROME SIMONOFF, VICE PRESIDENT, CITICORP INDUSTRIAL CREDIT; AND BRAD M. MESLIN, EXECUTIVE VICE PRESIDENT, THE CENTER FOR SPACE POLICY; DAVID W. GRIMES, PRESIDENT, TRANSPACE CARRIERS, INC., ACCOMPANIED BY EARL REESE, DIRECTOR OF TECHNICAL OPERATIONS, TCI

Mr. **Samuels**. Thank you, Mr. Chairman.

In keeping with your request, what I'd like to do, rather than go over a number of different alternatives that we could suggest is to simply outline a couple of assumptions that I've made in putting together my conceptual approach as to how such a venture might be possible.

And what I've assumed in going ahead with this is that, one, the U.S. Government will require manned capacity in space, and two, that the Government will assist the private sector in some way in accomplishing that function.

One aside as far as that aspect is concerned, though, and that is that in some of the proposals that we've seen earlier today, it was put forth, a set of objectives, wherein virtually everybody that was involved in the project enjoyed basically an optimal solution and I don't think that given the circumstances that we're facing today that that's entirely possible and given the set of—or the set of people that are involved in such a venture, meaning the Government, the private sector, the corporations, that sort of thing, the entity that has the greatest amount of flexibility in that whole scheme is obviously the Government and I think they're going to have to exercise that flexibility to a certain extent so that perhaps the other elements can enjoy a more optimal solution.

Also, obviously, in going ahead with these assumptions here, the budgetary constraints—obviously we're looking to minimize the capital cost to the Government and also I think it's necessary for the private industry—private sector to make some sort of a financial contribution. So those are the set of assumptions that I've made in looking at my proposal and in keeping with that, a solution might be that—as far as from the Government's perspective that, one, the Government would issue a zero coupon convertible bond and, two, that they would obligate themselves on that bond to pay back only the principal, not the face value at the maturity of that bond.

They would also guarantee to purchase a minimum number of flights from whatever entity wound up operating the manned shuttle capacity and, three, that they would offer insurance for the vehicle itself as well as for the payloads involved.

Mr. **Nelson**. You're saying that would be offered by the Government.

Mr. **Samuels**. That's correct.

As far as the corporation, that would be the recipient of this—that could be created through a bidding—a competitive bidding process and that corporation could involve either the design, the manufacture, the construction, the operation or the leasing of the shuttle. I think that that's something that remains to be determined. But essentially, the flows of revenues or profits from that corporation, assuming that it were successful, would be used to retire the debt and assuming again that the corporation were successful that there would be a remaining entity at the end of, say, perhaps a 10-year timeframe in which this debt would be converted into so that investors in that—or holders of that instrument would then become an equity participant in the corporation that was created to perform any or all of the functions that I outlined earlier.

If this were accomplished in this fashion, the benefit to the Government would be to obtain the use of a major capital asset at a reduced capital outlay at the outset and as far as that goes, some of the other debt instruments or lease payments, the advantage of a zero coupon bond in this set of circumstances would not necessitate the Government to pay a fixed stream of income over the period that this instrument would be outstanding.

As far as the private sector is—is concerned, they would be guaranteed the principal on their debt and the structure of the arrangement would essentially be back-end loaded to reward a successful operation, so that if the venture were successful, they would receive the assumed coupon rate of the zero coupon bond really or the return, rather, and they also have the opportunity to participate in a return that might be over and above that if the operation were successful.

The down side, as far as this proposal is concerned, would be that if the operation were unsuccessful and if the market were not mature enough to make this an economically viable proposal, that the Government would be obligated, of course, to pay the principal and the asset would revert to them and the investors in this debt instrument would, of course, have lost the time value of their investment, but would receive their principal.

That's essentially it.

[The prepared statement of Mr. Samuels follows:]

SPACE FINANCING

STATEMENT BEFORE THE HOUSE OF REPRESENTATIVES ON SPACE SCIENCE AND APPLICATIONS

by

James P. Samuels

First Vice President, Shearson Lehman Brothers Inc.

March 19, 1986

Investors appear to have an enthusiastic appetite for space related projects. Unfortunately, though, most space proposals do not stand up to the rigorous analysis that prudent investors perform on prospective business opportunities. Either the risk appears too great, the payback too long, the projected returns insufficient, or the necessary capital is too large. Many efforts have been made to remove these obstacles, and most suggestions have centered on some form of government support (i.e., tax incentives, guarantees, government purchases, and subsides). Each of these suggestions, though, has associated problems, and to date the bulk of private sector capital for a wide variety of space oriented ventures has come from internally generated funds of the major aerospace companies. A partial list of these efforts would include: communications satellites, remote sensing, materials processing, and space support services. Each sector has met with varying degrees of success, and the one distinguishing element, in our opinion, is the degree to which the necessary infrastructure was available. In other words, production quantities of materials in space will probably not occur until adequate production facilities are constructed.

In contrast the launching of communications satellite is now a commonplace, privately financed event. Granted the communications satellite industry received government support at the outset, but so did the railroads, barge companies, and airlines in differing degrees during their development. In these examples the government generally created the infrastructure that enabled the private sector to develop a business.

The shuttle or a similar vehicle should be viewed as a necessary piece of the infrastructure for the commercial development of space. The only question should be what role the government will assume in assuring that a manned launch capability is available. This subject could be debated at length, but rather than argue the merits of many alternatives we will make a few assumptions and outline a general solution for the replacement of the lost shuttle at minimum cost to the government and with the potential for attractive returns to investors. The general assumptions are:

- o Manned launch capacity is necessary for the commercial development of space.

- o The government will assist in some fashion to assure that manned launch capacity is made available to the private sector.

- o Due to budgetary constraints the cost to the government should be minimized.

- o Private industry must make some financial contribution of its own.

Given these criteria, the most difficult task will be to create a package that in sufficiently attractive to private investors so that the project can compete with alternative investment opportunities. This simply means that the risk/reward must be commensurate with other commercial projects.

For purposes of this discussion, we will assume that a new shuttle equivalent can be built for approximatly $2 billion. To finance such a purchase, the government would issue a zero coupon convertible bond wherein the government would guaranty the principle but not the interest. If the imputed interest rate were slightly higher than conventional treasury instruments, the actual outlay to the government would be about $1.1 billion (i.e., $2 billion, the approximate cost of a new orbiter, less the present value of $2 billion discounted at 8% over 10 years).

A corporation would be created to contract for the construction of the orbiter and to manage the operation and/or the leasing of the shuttle equivalent. The government would obligate itself to purchase a minimum number of flights per year for the 10 years (i.e., the time to maturity on the bond) at a rate competitive with alternate launch vehicles and the current shuttle fleet. Cash flow from operations would be used to retire the convertible debt which would also be convertible into the operating corporation.

This structure would reduce the initial capital expenditure to the government by approximately 45%. Also, the convertible feature could raise the potential return to investors to a level that would be commensurate with projects of similar risk.

Other features could require that the major vendors participate as investors and/or that the pension funds of associated builders also be required to invest in the project. The government would not guaranty the performance of the corporation — only the principle on the initial debt — and would also commit to purchasing a minimum number of flights.

Another helpful role the government could play in this venture would be to provide insurance coverage for both the new orbiter and payloads. Considering the current problems in the insurance industry such coverage would provide considerable advantages to the operator. This coverage would not have to extend beyond this specific orbiter and would not require any additional capital unless a loss actually occurred.

The corporation itself would be established through a competitive bidding procedure wherein qualified management teams, corporations, etc. would compete for the opportunity to operate the business of the designing, manufacturing, and marketing a manned spacecraft.

The risk to the entire project, of course, is that a minimum flight rate is not achieved and/or that the operation of a shuttle vehicle is not yet a commercially viable business. In either of these circumstances the corporation would not generate sufficient income to achieve the objectives of a profitable business. Under that set of circumstances private investors would receive only their original principle and would forfeit the time value of their investment.

The government would be obligated for the principle which would not be derived from the operation of the business. In other words if the construction and operation of a fourth orbiter is not an economically viable business, somebody will have to pay for it. If, on the other hand, the market place is mature enough to make such a proposal economically feasible, the government will obtain the use of a major capital asset at a reduced cost and investors will receive a competitive return on their money.

JAMES P. SAMUELS

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Experience: Shearson Lehman Brothers, Inc. May, 1983 to present. First Vice President. Formerly with Lehman Brothers prior to merger. Primary research coverage - defense electronics and telecommunications. Established first investment coverage of commercial space. Publish a monthly space investment report which is sold to non financial companies on a subscription basis and distributed to financial institutions as part of the Shearson Research effort. Have appeared before the Senate and House Subcommittees on commercial space and have spoken at numerous seminars on financing commercial space ventures. Combine written reports, telephone contacts, personal visits, and group presentations to communicate effectively with clients.

Merrill Lynch. February, 1980 to May, 1983. Primary coverage - High Technology with specific emphasis on defense electronics and telecommunications. Cited by a majority of top 100 institutional accounts and ranked #2 in Greenwich survey for military electronics. Was promoted from Industry Analyst to Asst. Vice President to Vice President within 18 months.

Brundage, Story & Rose. January, 1979 to February, 1980. Provided in depth research on broad range of industries. Written reports made specific equity recommendations which became integral part of firm's investment strategy and were ultimately reflected in personal and corporate portfolios. Actively participated in account supervision.

U.S. Trust of N.Y. June, 1976 to January, 1979. Maintained ongoing investment responsibility for airline, aerospace, pollution control, and lodging industries. Performed primary research and communicated investment strategies through written material and oral presentations.

Education: Wharton Graduate School — MBA - Finance. 1976. Emphasis on securities analysis, investment banking, and accounting.
Univ. of Pennsylvania — B.S. in Economics. 1968.

Military Service: Captain. U.S. Air Force. Pilot. January, 1969 - June, 1973

Background: Raised in the New York area and have traveled throughout the world in conjunction with employment. Earned varsity letters in three sports in college and prep school. Elected to both Junior and Senior college honor societies.

Special Licenses: Commercial Pilot: Insurance Broker, N.Y.; Registered Rep.; Level I CFA.

Interests: Sailing (New York Yacht Club, Seawanhaka C.Y.C.); Ice Hockey (Beaver Dam Winter Sports Club), Cooking.

Personal: Married (two children)..........Excellent Health

Mr. Nelson. Mr. Bliven.

Mr. Bliven. Thank you, Mr. Nelson.

I'd like to start off by making a slight correction on what was said before. I have retired from the Bankers Trust Co. I was senior vice president in charge of the airline, airframe, aerospace. I'm presently president of the Center for Finance, which specializes in providing financial advice and arranging financing. I'm appearing today, however, as president of the Space Commerce Roundtable Foundation. That organization provides a communication link between the Government and the financial community.

I was asked to focus my remarks on the—or I understood I was asked to focus my remarks today on the feasibility of the private sector undertaking the financing and operation of—of a shuttle—of a replacement shuttle. I should stop right here. What I'm hearing from people around here is not undertaking the operation of a shuttle vehicle. I'm hearing that using a lease vehicle to finance a shuttle vehicle and that's quite—quite different.

However, before I go on, I'm compelled to express my personal grief for the tragedy that has befallen this Nation and I believe it is imperative that we move forward with our commercial space effort. There are many reasons, not the least of which is those brave seven, so those brave seven shall not have died in vain.

Some time ago, I monitored a symposium at NASA on the commercial use of space. I had in mind reviewing that somewhat in detail and you—I apologize for the fact you didn't have my statement until just recently.

I'll try to highlight it. I think it might be useful if I were to just run over the financial markets part of the statement, to give you a better idea of where people are trying to go for money and what conditions those marketplaces might impose on those going in.

To date, as you undoubtedly know, the greatest interest in space has come from the venture capital segment, followed by the banks and then the institutional investors and last, the insurance companies. Of course, this is consistent with the state of the commercial use of space. It implies that one should not expect, however, in the near future, substantial financial support from segments of the financial industries that control a most significant portion of available funds.

It is assumed that if this is true, that the degree of interest is due to the somewhat exploratory state of commerce in space in areas other than communications. The venture capitalist—his interest is quite proper, because venture capital is what the name implies. Capital that owners are willing to place at what they consider high risk with the expectation that they will be rewarded for such risks by high return. This is an essential and worthwhile part of the capital formation process.

Unfortunately the funds from this source are relatively limited. Most venture capital transactions are denominated in the hundreds of thousands or several million dollars. The capital-intensive nature of space ventures often puts them beyond the scope of anything financed in venture capital history.

The high-grade equity market is capable of generating 10 times the amount of new capital, that's venture capital with annual flows of new common stock at as much as $25 billion. In order to be able to sell an equity issue, the marketplace—in the marketplace, however, a company would need to have a proven track record of generating profits over a period of several years. The space ventures in and of themselves cannot meet this test. Besides, the new issue equity market is small, generating new capital perhaps of $5 billion in most years.

Most funds in the American economy consist of debt instruments, overshadowing by far the equity that can be generated even in a good year by venture capital and the stock market is the lending power of the commercial banking system. The bank short-term loans amount to $75 billion per annum and possibly higher in a good year.

Life insurance companies, long-term funds amount to $40 to $50 billion a year. In addition, pension funds amount to perhaps $75 billion annually, excluding our thrift institutions with their annual $100 billion since they are single-purpose institutions.

A purchaser of debt instruments has made a decision to settle for a rate of interest in exchange for the removal of most of the risks associated with equity investments. Bank loans are generally for shorter duration than other debt instruments and again, as the compensation is a rate of interest, the banks and their regulators will require risks to be minimal.

As can be seen, the American financial system is quite capable of supporting commercial space effort. However, space projects must compete in the marketplace with other investment opportunities and as the demands increase, many sources of funds will be required. For the most part, space projects have been and still are supported by a small portion of the equity base of major corporations or by venture capital.

One should not expect substantial participation by other investors until they have a thorough understanding of the risks and believe they meet their criteria.

In previous speeches, I've talked about the problem of a corporation making substantial long-term investments that are dependent on the shuttle for success without any firm assurance that the shuttle would fly in future years or without indemnification for losses caused by such delays.

I would question the ability of a private company to provide such insurance or to obtain insurance against losses resulting from the inability to provide timely transportation services. Until such insurance is available, the financial community is not able to extend credit based on the viability of a current—of a given project.

This is now a major problem as a result of the loss and the expected delay.

I have not talked here of the problem of securing insurance and I think Mr. Rockwell talked a good deal to that. It is not currently available in the public sector. Now we're talking not only of insuring the vehicle itself; we're talking of insuring the cargo; we're talking of insuring the operation of the vehicle and all of these are substantial problems one must face.

To try to get the issues together that I think you gentlemen are attempting to focus on, it is who is responsible for the operation of the vehicle. Who is responsible for failure of the system? The losses caused to the user and the loss of the vehicle, cargo and damage. These are the risks we're looking at.

If those are not insurable and if those are assumed by the Government, as has been suggested, then the private sector can raise money. When I'm talking of where the private sector will or will not finance, I'm talking of credit risk based on a specific project.

In the case of the financing of the orbiter as proposed, the ultimate responsibility would fall on the U.S. Government for making of the lease payments which in turn back up the debt which then makes all of the markets available to whoever is going out in the marketplaces. Without such insurance, the markets become restricted, as I've said, and I'll stop there.

Thank you.

[The prepared statement of Mr. Bliven follows:]

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**SPACE COMMERCE
ROUNDTABLE FOUNDATION, INC.**

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TESTIMONY PRESENTED BY:

JOHN S. BLIVEN
PRESIDENT

AND

DR. ANTHONY J. CIPRIANO
CHAIRMAN OF THE BOARD

OF THE

SPACE COMMERCE ROUNDTABLE FOUNDATION

TO THE

HOUSE SUBCOMMITTEE INVESTIGATION

ON THE

PRIVATE FUNDING OF A REPLACEMENT

SPACE SHUTTLE ORBITER

MARCH 19, 1986

WASHINGTON, D.C.

My name is John Bliven. Until recently, I was a Senior Vice President of Bankers Trust Company, New York where I was in charge of the banks Airline, Airframe and Aerospace industries worldwide. I am now President of The Center For Finance of New York, specializing in providing financial advice and arranging financings. I am appearing before you today as President of The Space Commerce Round Table Foundation. This organization provides a communication channel between the government and the financial community.

You have asked me to focus my remarks today on the feasibility of the private sector undertaking the financing and operation of a replacement shuttle.

Before I address the subject, I'm compelled to express my grief for the tragedy that has befallen our nations great space effort. To my mind, it is imperative that the nation move quickly ahead with the commercial space effort. There are many reasons, not the very least, that those brave seven shall not have died in vain.

Sometime ago, I monitored a symposium on financing the commercial use of space. The principal thing that has occured since then is that the risks have increased materially. Thus, it would seem appropriate to review significant parts of my report on that meeting.
In order to place that summary in proper perspective, I quote specific portions of space directives or policies.

* * * * * * * * * *

"The United States Government will provide a climate conducive to expand private sector investment and involvement in civil space activities..." (President Reagan)

"Unless the public and private sector join to develop the opportunities presented by new space technologies and unless entrepreneurial forces are engaged more fully, the United States will fall behind in the contest for leadership in space and the economic rewards associated with that position." (National Academy of Public Administration)

"Commercial activities in space by private enterprise should be expanded now if our nation is to retain and improve its leadership in science and technology, its high living standards, and its advantage in international trade." (NASA Commercial Space Task Force's conclusions)

"NASA will expand its traditional links with... financial and non-aerospace industrial and academic communities.

"The NASA Commercial Policy supports commercial space activities through reducing the risks of doing business in space to levels competitive with conventional investments.

"NASA must assure these investors of reliable and dependable round-trip transportation for their projects ...

"Commercial space endeavors offer the potential for new industries, new jobs, lower production costs and an improved balance of trade ... Private investments in space, in turn, are expected to ... help maintain U. S. space leadership and enhance the nation's competitive position ..."(NASA Commercial Space Policy)

The question posed here is the possibility of a shuttle type vehicle being financed, built and operated by the private sector. This is a commendable objective and one that should be pursued for the future but regrettably I must conclude this is not a reasonable objective at the present time.

One might start a discussion of the why's by looking at the financial community and the interests shown in space.

To date the greatest interest has come from the venture capital industry, followed by the banks, then the institutional investors, and lastly, the insurance companies.

This seems consistent with the state of the commercial use of space. It implies that one should not expect, in the near future, substantial financial support from segments of the financial industries that control a most significant portion of available funds. It is assumed, if this is true, that the degree of interest is due to the somewhat exploratory state of commerce in space, in areas other than communication satellites.

As noted, the venture capital representatives seem to have the greatest interest. This is expected and quite proper. Venture capital is what the name implies -- capital that owners are willing to place at what they consider high risk with the expectation that they will be rewarded for such risks by high return. This is an essential and worthwhile part of the capital formation process.

Unfortunately, the available funds are relatively limited. It is estimated the venture capital industry has 13 billion dollars under management today. During 1984 the volume was 1.2 billion dollars. Most venture capital transactions are denominated in hundreds of thousands of dollars or several million. The capital intensive nature of space ventures often puts them beyond the scope of anything financed in venture capital history.

The high grade equity market is capable of generating ten times the amount of new capital as venture capital -- with annual flows of new common stock at as much as twenty-five billion dollars. In order to be able to sell an equity issue in the marketplace, however, a company would need to have a proven track record of generating profits over a period of several years. Space ventures, in and of themselves, can not meet this test. Besides, the "new issues" equity market is small -- generating new capital of perhaps five billion dollars in most years.

Most funds in the American economy consist of debt instruments.

Overshadowing by far the equity that can be generated even in a good year by venture capitalists and the stock market is the lending power of the commercial banking system. Bank short-term business loans amount to seventy-five billion dollars per annum, and possibly higher in a good year.

Life insurance companies' long-term funds amount to forty to fifty billion dollars each year. In addition, pension funds amount to perhaps seventy-five billion dollars annually. Excluded are thrift institutions with their annual one hundred billion, sine they are single-purpose institutions.

A purchaser of a debt instrument has made a decision to settle for a [redacted] rate of interest in exchange for the removal of most risks associated with equity investments.

Bank loans generally are of shorter duration than other debt instruments and again, as the compensation is a rate of interest, banks and their regulators will require risk to be minimal.

As can be seen, the American financial system is quite capable of supporting commercial space efforts. However, space projects must compete in the marketplace with other investment opportunities and as the demands increase, many sources of funds will be required.

For the most part, space projects have been and still are supported by a small portion of the equity base of major corporations or by venture capital. One should not expect substantial participation by the other investors until they have a thorough understanding of the risks and believe they meet their criteria.

In previous speeches I have mentioned the problem of a corporation making a substantial long-term investments that were dependent on the shuttle for success, without any firm assurance the shuttle would fly in future years, or without indemnifcation for losses caused by such delays.

I would question the ability of a private company to provide such assurance or to obtain insurance against losses resulting from failure to provide timely transportation service. Until such assurance is available the financial community will not be able to extend credit, based upon the viability of a given project.

This is now a major problem as a result of the loss and the expected delays.

As the financial community explores possible financings, the position of the company in its industry is given careful consideration. Much attention has been focused on the problems of foreign competition, as the terms they will accept and the support they receive from the host country frequently exceeds that provided by our free enterprise system or government.

These factors seem to concern themselves with the intricate problems that arise when government and the free enterprise system attempt to coordinate their goals and objectives. This effort becomes all the more complicated as our nation coordinates with its allies, whose governments do not necessarily have the same goals and objectives, and whose industries may not be driven by the same forces as our free enterprise system. These factors are compounded by the growth of multinational and international joint ventures.

If we are to be successful as a nation in space, if we wish to have our free enterprise system leading, as it should, the commercial use of space and if we are to fulfill the objectives set forth herewith, then we must assure ourselves that our democratic and free enterprise system is not placed at any disadvantage versus any other system.

Failure not only to adhere to this principle, but to closely monitor the ever-changing circumstances, could seriously restrict the funds available to U.S. ventures.

This includes the nacessity to move forward with our space effort as quickly as prudently possible. We must not loase the advantage we now posses with the only re-entry vehicle, which is the backbone of our future commercial space.

I have not spoken to the problems of securing insurance on the shuttle or its cargo as I assume you will have insurance experts appearing before you. My limited knowledge indicates this is a major problem for the government and an impossible hurdle for private enterprise.

Thank you,

March 18, 1986

JOHN S. BLIVEN.

Mr. NELSON. Under that scenario, how long do you think it would take to raise $2 billion on the private market?

Mr. BLIVEN. It would, to a great extent, depend upon the timing that one went to the marketplace. It would depend upon, as we would be talking of virtually a Treasury-type issue, it would depend upon what the Federal Reserve was doing in the marketplace at that point in time. Going for a $2 billion issue at one time would probably be a very agressive posture and it probably would have to be spread over a period of time and phased in with other financings in the marketplace.

Mr. NELSON. Well, are we looking at a matter of weeks, months, a year?

Mr. BLIVEN. I would think more months.

Mr. NELSON. Months. Not necessarily a year. Possibly?

Mr. BLIVEN. It could be, could be, but realize conversely if you're talking of building your vehicle, you're talking of considerably longer than that. The timing ability to raise money should not interfere with the project. It would, however, as the interest costs would start running earlier and possibly cause some additional costs.

Mr. NELSON. OK.

Mr. Simonoff.

Mr. SIMONOFF. Thank you for having me here. It is always a personal honor to be here and my comments are my own, not those of Citicorp.

Rather than spend the time repeating what many people have said, what I would like to do in the first half of the testimony is perhaps straighten out some concepts that seem to have gotten mixed up in the preceding testimony.

In the—in the lease issue itself, a lease is, for all intents and purposes, a low-cost form of Government borrowing for this thing. You're substituting Treasury borrowing for—for another form of obligation. What you have—what is happening here is that with the—given the size of the procurement that we're dealing with, the overwhelming amount of funding that a leasing company, an owner must have to make a—a profit from a lease will have to be debt. That says that the risk characteristics that the leasing company must face are—are primarily those of assured revenue, Government taking the responsibility for operation, for repair, for maintenance; there is nothing unusual about this.

The mitigation of the cost to the Government would be obtained from the sale of the tax benefits and from the sale of any perceived residual income that would come once the debt is repaid.

In the commercial world—there was a question—two questions that were mixed up on the rate-of-return question. In the commercial world, the reason you lease, or in many cases the reason you lease, aside from the flexibility of use, but long-term lease is because the de facto interest costs—the lease rate gives you de facto interest rate of 4, 5, 6 percent lower than the borrowing rate itself.

So that says that if you're a corporation, you could take the best rate; you could then reduce the borrowing because you've sold some of the tax benefits and leased this thing and you get the reduction.

Mr. NELSON. Would that be operative here for the Government?

Mr. **Simonoff.** Not so clear. It's not clear—it's partially operative. This was discussed perhaps in the greatest detail at NASA in the old TDRSS hearings. There was, if I remember the name, Gerald Tryszinski, was that the right name—yes—prior to NASA's obtaining the Federal Financing Bank's financing, they looked at commercially financing.

The rationale was that—that if you reduced the borrowing—you get this—this—this reduction of "rate," but you then forego tax benefits. The argument was that the—any—any lender to the Government, any holder of Treasury bills has to pay income tax on his interest income so the net effect to the Government is some reduced number.

Now, if the holder of Government Treasury bills is a nontaxpayer, foreign government or trust fund, then there could conceivably be some benefit to the Government, some lower cost. Then we start to take into account the insurance issues. I would guess, without looking at the numbers hard, that you'll probably end up being Treasury-neutral. But the Treasury people could probably answer that best.

Now, what I—what I—in looking at this lease financing, as was, I believe, correctly pointed out, the shuttle itself cannot be a self-supporting vehicle. You cannot—it cannot finance itself through its revenue generation and the reason it can't is because the shuttle pricing is such where you just cover the additive cost; you do not cover the cost of capital. So you have a de facto obligation on the taxing power of the Government to support a lease. That's the bottom line of what we're dealing with.

So what—so what you then have is three options. Number one, the Government can adjust, through its normal procurement process, issue its Treasury bonds and then buy a shuttle the way it normally does; the second thing is that we could go through the type of structure we had here, commercial debt with all the Government guarantees, and the raising of the equity through the sale of the tax benefits, or, if you want a cheaper way, the Government supply the debt and just sell the tax benefits. So that's even lower cost, but again it's a—all of these are complex.

Now, given the sensitivity—given the time sensitivity, if it is determined through the studies of the manifest requirements, the DOD requirements, NASA, and everybody else that another shuttle should be bought, or come out on this is for the Government to simply directly buy the shuttle—just—just do it. Now, fortunately, in this—in the financial world, unlike any construction project, you always have a second and third and fourth chance so my recommendation would be that as—that the Government do this, and that as Mr. Rockwell's investment bankers come up with the structure, if they can demonstrate the structure's worth something, then replace the Government funding with the lease that Mr. Rockwell provides.

I would also point out here that there's perhaps another opportunity or a further simplification. In the study of the—in the lease, we're talking about leasing a new shuttle. The shuttle doesn't exist until it's complete. That says you've got 3 to 4 years of inventory—of something under construction, and the construction financing is no mean feat. That in itself is a very difficult process. It is almost easier to do a sale lease-back of an existing orbiter like the Discovery. Simply get the cash and then the Government can use that to—to buy the shuttle. However, the argument for that is the same as that the benefit to the Government for a lease has got to be equal to or better than direct government borrowing.

So I'd say give Mr. Rockwell a chance, but don't confuse issues. Keep it simple, do the buy, if indeed the Government wants to buy the thing, and sometime later, when everybody's done his homework, get this thing done.

I would like to add one—one additional thing—as I say, an unsolicited addition which is really—I couldn't figure out where to put it in so I put it in at the end—that when we do get the shuttle, that the Government review the economic performance criteria that it places on the shuttle.

I would like to see personally an end to the Government/private industry competition for market share for transportation. I believe that is some rationale can be worked out.

I feel that the criterion of success for a space program from the private sector is—or from the Government for that matter—is not who has what share of market. The criteria of success is what policy makes the most capital come into the market. That should be overwhelming and I would—I would look for innovative ways that ELV suppliers can have to help engender the generation of this capital.

That ends my testimony and thank you very much.

[The prepared statement of Mr. Simonoff follows:]

TESTIMONY OF
JEROME SIMONOFF
VICE PRESIDENT
CITICORP INDUSTRIAL CREDIT, INC.

BEFORE THE
SUBCOMMITTEE ON
SPACE SCIENCE AND APPLICATIONS
OF THE
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

MARCH 19, 1986

The views expressed in this testimony are solely those of the witness and do not represent those of Citicorp, its subsidiaries, or affiliates.

My name is Jerome Simonoff. I am a Vice President of Citicorp Industrial Credit, Inc. I am involved in originating space and telecommunications financings at Citicorp. The views expressed in my testimony are strictly my own and do not represent the views of Citicorp or any of its subsidiaries or affiliates.

Today, I wish to discuss the issues surrounding the ability to commercially finance the purchase of a new Shuttle orbiter. I will list criteria that I believe are necessary to enable the raising of funds from the commercial debt markets, and how they apply specifically to the vehicle. The issue of debt is important because the vehicle's high cost makes borrowing essential to the purchase or lease of an orbiter.

The NASA announcement dated 1/14/1986 requires among other things that any private financing would not result in increased prices to shuttle customers. This requrement dictates a financial structure that would reduce the amount of overall borrowing needed to purchase an orbiter. The difference between the purchase price of the vehicle and the amount of required debt is provided by cash from investors who seek profits from a combination of (1) long term revenue potential after the repayment of any debt financing and (2) potential profits from obtaining tax benefits. In this type of financing structure, the tax benefits are tax deductions derived from "depreciation" of the orbiter. This form of financing is called a tax sensitized lease. (The rules for employment of the tax benefits in the case of the shuttle replacement would most likely be covered by Section 31 of the Deficit Reduction Tax Act of 1984. This Section contains special rules that are appropriate for leasing to tax exempt entities.)

Recommendation

Assuming the Government chooses to replace the orbiter, for simplicity and timeliness, the Government should initially directly fund a replacement vehicle. The funding should be done with the proviso that if sufficient private funds can be raised, and the other mutually agreeable conditions, including those outlined in the NASA announcement can be met, privately raised funds would replace Government funding.

BACKGROUND

The Need for Debt to Supplement Investment for Large Projects

Investment (equity) funds are attracted on the basis of the ability to provide returns on equity ($ of profits per $ of investment) that are competitive with alternative non-space related opportunities. At a $1.0 - 1.5 billion replacement cost, the prices charged to shuttle customers to generate the necessary minimum profits would be prohibitively high. Therefore, to reduce minimum necessary prices to customers, debt would have to be used to substitute for, and shrink the size of, the investment to enable lower profits to generate a competitive rate of return on investment.

Lenders' Perception of the Purpose of Debt

Lenders generally perceive the purpose of debt as a time bridge between the outflow of funds (in this case to build an orbiter) and the expected repayment either from the existing normal course of business or contractual commitments. Risks that debt will take are normal credit risks, the variation of the cost of funds in the capital markets, the ability of a government to raise taxes from a strong economy, or the ability of a management to execute a business strategy with a high degree of predictability. Lenders generally will not take business risk, i.e., if the business is successful, the debt will be repaid. This risk is borne by investors.

What Criteria do Lenders Usually Employ to Provide Debt?

Lenders look first to borrower's ability to generate cash as the principal method of repayment, second, a guarantee of repayment from a third party, or third, the right to sell an underlying asset to repay a loan in case of a default. Naturally, lenders expect that sufficient property and casualty insurance is maintained in amounts consistent with the level of borrowings. The degree of reliance on the alternative methods of repayment varies with the strength of the borrower. Clearly, a lender to the U.S Government (i.e., a bond holder) considers only the taxing ability as the basis for repayment.

How Would a Commercially Financed Orbiter Fit These Criteria?

Cash flow:	At today's user prices, the commercial revenue from an orbiter could not support the required debt to purchase a new one. Prices are set to just cover operating costs. The lenders would have to look to the generation of cash from other sources such as fees charged to the U.S. Government for using flights.
Predictability (Usage Commitments)	Since commercial user prices are not set high enough to cover capital costs, the issue of commercial usage commitments is not relevant. Only Government usage commitments at elevated prices are meaningful. However, Government commitments are limited by the annual appropriations process. Since many of the shuttle's payloads have either a research orientation or could fly on other U.S. Government sponsored transporatation systems, it would be extremely difficult in today's market to expect lenders to take the annual appropriations risk.
Alternative Means of Repayment	There is no realistic secondary market for the vehicle or its components that could provide sufficient funds to repay large amounts of debt.
Insurance	There is insufficient insurance capacity in today's market to support the level of borrowing or investment required for a new orbiter. This can be mitigated by either having the Government provide the insurance or pay unconditionally on an agreed upon schedule for use of the orbiter whether or not it is used or damaged (sometimes called a "take or pay" contract).

Available Funding Options

In summary, the simplest choices open to the Government are:

(1) The Government fund a new orbiter through its own standard funding sources;

(2) The Government enter into a tax lease with the commercially raised debt and private investment (Since the user prices cover additive costs only, and the NASA requirements specify no price increase to cover capital costs, the Government would have to guarantee the debt. The commercial sources would provide investment through the sale of rights to tax benefits and Government fees received after the repayment of the debt.); or

(3) The Government supply the debt for the tax lease with investors supplying the equity. (In this case, the Government would probably still have to supply launch insurance or an equivalent usage commitment to support the equity.)

Options (2) and (3) would require legislation similar to that needed to enable the multi-year lease of the TDRSS system.

Recommendation Considering Timing, Simplicity, and Flexibility

Given the time sensitivity of starting the replacement process of the Shuttle, it seems that the most appropriate form of initial financing would be direct Government funding for a replacement. However, there may be potential advantages of private financing that are not apparent. Also we should not preclude the possibility that some new, imaginative financial vehicle could be created to raise such funds.

Therefore, I recommend that the Government follow a policy that would afford maximum flexibility and minimum replacement time. Assuming the Government chooses to replace the orbiter, it should initially directly fund the vehicle. Furthermore, there should be a proviso that if sufficient private funds can be raised, and mutually agreeable conditions, including those of the NASA notice of inquiry are met, privately raised funds would replace the already started Government funding.

This ends my testimony. Thank you for inviting me to speak before you.

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Attn: John E. Moore - HWE

A - PURCHASE OF A FIFTH SHUTTLE ORBITER BY THE PRIVATE SECTOR

NASA is seeking expressions of interest from the private sector to invest in extra STS Fleet Capacity. NASA is considering the possibility of entering into an agreement with a private sector proposer for the purchase of an Orbiter over and above the existing fleet of four. Such agreement, if undertaken, should be advantageous to the Government and encourage the Commercial Development of Space. Guidelines for proposals for such an agreement are as follows: (A) Any agreement between the Government and a private sector proposer to purchase an orbiter must provide for the exercise of national security, rescue, or NASA priority missions. (B) The Government has made a major investment in the STS and the terms and conditions must appropriately recognize the investment and must contain methods by which the Government gains as each party shares appropriately in the risks associated with operations. (C) The private sector proposer would be making a major investment in extra STS fleet capacity and should have the potential for an appropriate profit over the lifetime of the investment. However, the appropriate return-on-investment must not add to the price for shuttle customers. (D) The primary requirement of the national STS is a safe and effective operation, and the private sector proposer would have to agree to an orbiter configuration which is safe and will meet overall STS fleet requirements. (E) An agreement between the Government and a private sector proposer for the purchase of an orbiter cannot be exclusive or without competition. It must maintain an option for other interested parties to purchase an orbiter on a similar or equal basis. (F) Any final agreement between the Government and a private sector proposer for the purchase of an orbiter must be a public agreement, which is demonstrably in the Government's interest as well as meeting the legitimate needs of the proposer. Expressions of interest are requested not later than February 28, 1986, and should include an indication of a firm's qualification and capabilities, in terms of financial resources, technical expertise, and experience. This notice is not a request for proposal. Requests for additional information and responses of interest are to be addressed to Dr. Barbara Stone, Acting Deputy Director, Plans, Policy and Evaluation, Office of Commercial Programs NASA Headquarters, Code IP, Washington, DC 20545; Telephone: (202) 453-1896.

C.O. 1-14-86

Signature Title

Mr. Nelson. Do you think, Mr. Simonoff, that this kind of potential financing for an orbiter would in any way have some ripple effects for further encouraging investment in other commercial activities in space?

Mr. Simonoff. No.

Mr. Nelson. Other than in orbiters?

Mr. Simonoff. No.

Mr. Nelson. All right.

Mr. Simonoff. The reason I believe that is that each transaction, as John Bliven has pointed out, investment is in a competitive marketplace. The orders—the magnitude of the dollars required in space are so great that you're almost limited to sophisticated investors.

One of the odd quirks about this is that you cannot—because of the size of investments required, you cannot get competitive returns and equity without the use of debt to leverage up, such as utilities, telephone companies do. So what we're faced with is that most risk-averse conservative suppliers of funds are the ones that literally constrain the most advanced technology we've got. It's an interesting anomoly, but that's what we're faced with today because of the size of the investments needed for any particular space activity.

Mr. Nelson. Mr. Rockwell, before you leave, either you or Mr. Griffin, what do you think about Mr. Simonoff's suggestion of a sale lease-back of an existing orbiter?

Mr. Rockwell. That is probably what we would be proposing to NASA in order to get the thing on—started right now, the day we close.

Mr. Nelson. OK, then I'm glad we had that clarification because I thought we had been talking the whole time about the financing of a replacement orbiter.

Mr. Rockwell. Well, one way to accomplish the replacement of—the—of a replacement orbiter is to do just what Dr. Simonoff has said.

Mr. Nelson. All right.

Did you have a comment, Bob?

Mr. Walker. Just that the—the comment that I had was what if—what if, in the national policy sense, the borrowing up front by the Government or in effect for this committee the authorization of a spending stream, causes a reduction in our ability to do space station, do hypersonic plane, do a lot of the future development because we create a funding stream here.

Isn't that something that also has to be weighed in? I mean, I think you've given us good financial data, but the bottom line is within a fixed-cost criteria of the Government, don't we also have to calculate in the impact that it's going to have on all the rest of these areas if that funding comes out of the hide of other programs?

Mr. Simonoff. That's—that's absolutely right. I thoroughly agree with that and the most important point in making the comparison of—whether it be the aircraft or the—or the space station, is that these items are really—it's stand-alone issues is what they cost. The stream should be—should be looked as to how much money is committed and how much is at risk and how much is not at risk in the future. In other words, how much of a stretch-out can you have?

In the general accounting practices, for example, I heard the term "lease" here. In general accounting practice, though, a long-term lease is the same as a debt, as an obligation—is reported as a debt obligation. So what you have to do is make a determination as to—if an additional orbiter is to be bought, does that mean there's a stretch-out on space stations? Does that mean more free flyers? Does it mean the DOD has got to come up with some of its budget if it's the user for the thing? Maybe if they're going to use it and not pay for, well, maybe they've got to share the wealth—something like that.

Mr. **Walker**. But in most other applications that you would be talking about, you'd also have capital budgets that you would be using for that. We have no capital budgets in the Federal Government. It all comes out of the same spending stream pocketbook and that's, indeed, our problem.

Mr. **Simonoff**. That's correct.

Mr. **Walker**. Thank you, Mr. Chairman.

Mr. **Nelson**. Mr. Simonoff, thank you, very much.

Dr. Meslin.

Dr. **Meslin**. Thank you, sir.

The Center for Space Policy supports aerospace and nonaerospace firms in the evaluation of Government policies and space programs, both domestic and international, and in the development and implementation of business opportunities in Government space procurements and commercial ventures.

I'd like to make that clarification as opposed to the other gentlemen sitting here who are from the financial community.

From our perspective, there are really three critical issues to take into consideration in this discussion. The first, of course, has to do with continuity in manned launch capacity. What are the consequences of a lack of continuity and how do we ensure it?

The second fundamental issue, I think, is the role of the private sector in supporting replacement capacity as we've been discussing this afternoon. And finally we come to the role and responsibility of the Government also in addressing the replacement capacity.

With respect to the first issue, loss of the *Challenger* and its crew deprives the United States of more than one-fourth of our manned launch capacity for at least 2 years and perhaps for much longer. In STS language, we would say that the sum of the four-orbiter fleet is greater than the total of its parts.

A significant store of spare parts was lost in the accident. This is likely to increase average repair and turnaround times far beyond the 74-day average of 1985, leading to a constrained flight rate of perhaps 12 flights per year, far less than were planned or are needed in the late 1980's and beyond.

Continuity in manned launch capacity is therefore jeopardized, even after a three-orbiter fleet returns to service. Expendable launch vehicles to meet DOD requirements represent a prudent move in our opinion, and may help to alleviate some of the constraints that we'll face.

However, we feel that significant reliance on ELVs for commercial payloads would likely result in increased launch costs to satellite operators, reduced transportation and tax revenues to the U.S. Government and the possibility of higher use charges to satellite customers. This is in the case of private expendable launch vehicles, not those sponsored by NASA.

In terms of the opportunity costs considered here, the absence of an additional or a replacement orbiter will translate into 6 or 8 fewer flights per year in our opinion, based on a conservative average of 18 flights per year with a four-orbiter fleet, during approximately the 10-year period until we might reasonably expect a follow-on operational manned system to be available, or some variation.

This shortfall would equal perhaps 60 to 80 fewer flights over 10 years and would result in 400 to 800 fewer days on orbit for research and development, experimentation, testing, satellite retrieval, repair, construction and space operations in general. In other words, the shortfall that we would experience by not obtaining replacement capability would effectively represent two to four times the total time on orbit since the shuttle fleet began to fly 5 years ago.

In terms of lost opportunity costs, we feel that not to obtain replacement capacity from a private-sector opportunity initiative or by Government procurement would do several things. It would slow the pace of commercial activity in space considerably. It would result in the loss or the deferral of tax revenues and new jobs that we believe would accrue from that commercial activity. It would cause further delays in the space station program due initially to delays in the entire manifest.

And perhaps most importantly, it would threaten American preeminence in global high-technology markets. We feel that that preeminence to a significant degree is founded on yesterday's scientific advances. Future preeminence will owe much to our position today at the cutting edge of space technology and science.

Therefore, we believe that orbiter capacity that is lost must be replaced quickly for reasons of national interest. That's really the fundamental point. It should include at least one orbiter, plus significant spares, or perhaps two orbiters.

Now how does the private sector fit in this—this perspective? First, we think that participation by the private sector is increasingly important, both to address fiscal constraints and to provide procurement alternatives in support of national goals in space. A privately funded shuttle replacement is an attractive concept on one hand. First of all of course it minimizes the short-term impact on NASA budgets through a variety of financing options, some of which have been presented today. Second, and perhaps equally importantly over the long term, private financing in terms of a leaseback of an orbiter may set an impressive precedent for closer Government-industry cooperation in off-budget financing of space hardware with positive implications for the space station and future Government space programs.

On the other hand, with the commercial space industry still in its infancy and the investment community still relatively unconvinced of either the Government's commitment to commercialization or the merits of investing in space, private financing of an orbiter would have a disproportionate impact on the perceptions and actions of future investors for many years to come—and I think here is a point at which I differ with Jerry Simonoff in that respect—a privately financed shuttle venture would represent the barometer, in our opinion, if not the entire environment, by which future space ventures would be judged for years to come.

Accordingly, both Government and the private venture in question must bear the harsh scrutiny of the investment community and must meet some if not all of the following criteria: first, the package must be financially sound and it must show an acceptable return on equity; second, the Government repayment guarantee, however negotiated, must be firm and unassailable by a future Congress or administration; third, the pricing for launch services to future customers must be immune from political or budgetary considerations that might dilute the back end of the deal; fourth, the firm responsible for the deal must of course be in sound financial condition—and here I agree with Mr. Blivens entirely; and finally, I think most importantly, Government policy must remain consistent enough that it does not represent an unacceptable risk to investors now or in the future—the Government in effect must be willing to mortgage its ability to change policy tomorrow in return for an attractive financial fix today.

So in our opinion the real question here facing all of us is not whether the private sector is capable of providing the necessary funds—I believe under certain scenarios it probably is—but in fact whether the Congress and the administration are willing to use the high-profile expensive example of a privately financed orbiter as the test case for a long-term Government commitment to a stable industrial space policy, because that's the way it'll be viewed by the investment community and by industry at large.

A privately funded option that may be attractive on its merits must also rely on a critical interagency policy consensus and a multiyear, multibillion-dollar legislated leaseback commitment of some sort. If this is viewed as achievable in the current environment, we would encourage this exercise to continue. If it is not achievable, we believe that the current pressing demand for replacement capacity should not be allowed to drive an ill-conceived policy commitment to the private sector. Thank you.

[The prepared statement of Brad Meslin follows:]

The Center for Space Policy, Inc.

TESTIMONY BEFORE THE

COMMITTEE ON SCIENCE AND TECHNOLOGY

SUBCOMMITTEE ON SPACE SCIENCE & APPLICATIONS
U.S. HOUSE OF REPRESENTATIVES

SUBMITTED BY:
BRAD M. MESLIN
THE CENTER FOR SPACE POLICY, INC.

MARCH 19, 1986

Mr. Chairman and Members of the Subcommittee:

My name is Brad Meslin, and I am the Executive Vice President of the Center for Space Policy, Inc. (CSP). Thank you for the opportunity to present CSP's views on the question of a privately funded replacement for our recently lost space transportation capacity. Our observations are presented from the perspective of a firm that has been intimately involved in helping to shape and advise business ventures and investment opportunities that support U.S. Government space programs and the commercial development of space. Our clients include major American aerospace contractors and subcontractors, leading financial institutions and a growing number of space entrepreneurs.

In the time alloted to me, I would like to address the requirement for a replacement orbiter and the ability of the private sector to meet this need, and then focus briefly on the implications of a privately-financed orbiter for the Government, the financial community and private industry in space.

The Space Transportation System is the most valuable national resource currently available to provide reliable access to space for a growing variety of scientific, commercial and national security programs. The recent, tragic setback caused by the loss of Challenger and her crew must not cause us to forget the original reason for declaring the STS to be this nation's primary space transportation capability: a reusable, manned system offers the most flexible and cost effective means to conduct increasingly diverse operations in space. Programs in life sciences, commercial materials processing, national security, satellite repair and retrieval, and construction of a permanent infrastructure in space all require the presence of man, and vehicles that can return routinely to earth.

Will the effort to provide a privately funded replacement orbiter offer the continuity in space transportation necessary to maintain needed momentum in the programs just mentioned? What role does the private sector have to play in supporting replacement space transportation capacity? How would a privately funded orbiter address issues of concern to the Federal Government, including trade-offs with other NASA programs, pressures for budgetary constraint, and interest in encouraging commercial investment in space?

Let me begin with the issue of continuity in manned launch capacity. The loss of an orbiter deprives the United States of at least one-fourth of its manned space launch capacity for a period of at least two years, and perhaps for much longer. I say at least one-fourth, because we lost more than an orbiter and its crew when the Challenger accident occurred: we lost a significant store of spare parts ordinarily available to the remaining orbiters. In STS language, the sum of a four-orbiter fleet is greater than the total of its parts. According to figures obtained by CSP, during 1985 the average repair period for an orbiter was 79 days. Many repairs are often completed by "borrowing" needed parts from other orbiters. Since the Challenger crash depleted this inventory of "spare parts", average repair time can be expected to increase proportionally: we will be looking at repair intervals significantly greater than 79 days until the inventory is replenished. Couple this with the fact that an orbiter is due to be stationed at the new Vandenburg launch complex, and the repair problem is exacerbated. Knowledgeable observers suggest that these factors will result in fleet turnaround times of more than the 1985 average of 74 days and a constrained flight rate of perhaps 12 flights per year, far fewer than were planned, or are required through the late 1980s.

Continuity in launch service is therefore likely to be jeopardized to some degree, even after the 3-orbiter fleet returns to service. In order to mitigate this situation, replacement capacity must be obtained quickly, and in a manner that guarantees the continuity and reliability of manned space launch capability, primarily for commercial, and international uses that require the presence of man, and for time-critical military and scientific missions.

In order to provide regular, reliable service, the Space Transportation System cannot continue to operate on a marginal basis as it has in the past -- and will be forced into doing for the immediate future. Relying on near round-the-clock shifts at KSC and a practice of cannibalizing available orbiters invites continuous delays and the possibility of another disaster. Therefore, we would maintain that replacement capacity must include a commitment to procure either two new orbiters, or one orbiter plus the kind of robust spares program that represents an investment of a comparable magnitude to a second orbiter. Only then can the fleet be expected to operate with the margin of flexibility needed to provide safe, reliable service at steadily increased annual flight rates, while at the same time offering some measure of insurance against the likelihood of protracted downtime for an additional orbiter.

There are some who maintain that national launch needs could be met using a combination of 3 orbiters and increased reliance on expendable launch vehicles, particularly Titans for the Air Force, while we accelerate the development of alternative launch systems such as the TAV or Heavy Lift Launch Vehicle. Although some dependence on unmanned launch vehicles is prudent for military payloads, we feel that increased reliance on ELVs for commercial satellite missions would be ironically short-sighted. Looked at in terms of financial cost, such forced reliance would be likely to result in increased launch costs to satellite operators, reduced space transportation and tax revenues to the U.S. Government, and the possibility of higher use charges to satellite customers.

Looked at in terms of opportunity cost, the absence of an additional orbiter in the fleet will translate into 6-8 fewer flights per year, based on a conservative 4-orbiter average flight rate of 18 flights per year between 1988 and 1998 (a reasonably optimistic target date for the introduction of a follow-on operational system). This equals 60-80 fewer flights over a 10-year period or between 400 and 800 fewer days on orbit for research and development, experimentation, testing, satellite retrieval, repair, construction and operations. This shortfall represents two to four times the total time on orbit since the Shuttle fleet began to fly five years ago.

We believe that this lost opportunity would have a dramatic effect on slowing the pace of commercial activity in space, and would result in the loss or deferral of significant tax revenues and new jobs in the United States. It could not help but delay the Space Station program still further, because the whole manifest would experience lengthy delays. Perhaps most ominous would be the threat to American preeminence in competitive international markets, a dominant position that is founded on yesterday's scientific advances, and owes much to our current position on the cutting edge of space technology and science. We must replace the orbiter capacity, and do it quickly.

The private sector has an increasingly important role to play in supporting Government missions in space, and may be instrumental in this hour of need for the Space Transportation System. Passage of the Gramm-Rudman Act is expected to impose severe constraints on discretionary federal spending, and few observers would dispute that NASA's civil space programs are likely to be subject to special scrutiny in the months ahead. As fiscal constraints increase, reform of the federal procurement process resulting in increased competition and greater reliance on off-budget financing offer the prospect of a more efficient means of procuring space services in the future. Private financing of critical infrastructure associated with the STS, the Space Station and other privately developed space industry, may result in a broader Federal agenda in space, and the chance for Government budget planners to spread scarce resources over a longer period of time through innovative long-term leases.

However, serious consideration must be given to the feasibility of relying on private capital to replace the lost Shuttle orbiter while also ensuring a spares program sufficiently robust to ensure long-term, reliable, manned access to space. An investment of at least $2-3 billion may be required over the next five years to achieve this goal. Astrotech proposes to provide a combination of debt and equity financing equivalent to the price of a new orbiter, exclusive of additional spares. In its recommendation, the firm suggests that the Government guarantee return of principal and some return on investment, over a negotiated period of time, while Astrotech would depend on future revenues obtained from new commercial payloads to provide an attractive package to investors.

The recommendation has its merits. By stretching the period over which the Government would be repaying the direct cost of the orbiter, the impact on the Federal budget and on key NASA programs is minimized. The Government could purchase an annuity at a considerable discount over the $2 billion cost of an orbiter, making the financial impact even less onerous. And, leaseback to the Government of a privately financed replacement orbiter may set an impressive precedent for closer government-industry cooperation in off-budget financing of space hardware, a precedent that has far-reaching positive implications for the Space Station and the future development of space.

I would not presume to pass judgment on Astrotech's ability, or that of another private entity, to raise the necessary funds, even assuming the Government committed both to repay the cost of the orbiter over time and to embark on a vigorous, federally funded spares program. I might suggest, however, that with the commercial space industry still in its infancy, and the investment community still relatively unconvinced of either the Government's commitment to commercialization, or the merits of investing in space, private financing of an orbiter would have a disproportionate impact on the perceptions and actions of future investors for many years to come.

The possibility of financing a replacement orbiter through private channels has ramifications that go far beyond the bounds of a debt-equity deal that would already be of unprecedented size. The capital markets are not bottomless. In all of 1985, 334 ventures raised approximately $8.1 billion in initial public offerings, but only 6.7% of this amount (or $542 million) was in high technology ventures. In other words, the equity portion of the offering being contemplated would represent twice as much money as was invested in all high tech ventures in 1985. The magnitude of this offering, one that would be dependent upon consistency in Government policies for many years to come, would dwarf any previous initial financing and would represent funds that might otherwise have been spent on literally dozens of other ventures, perhaps many of them in space.

Given the somewhat shaky history of space venture financings to date, investors are likely to be wary of new offerings, particularly those dependent on a Government policy commitment and a Shuttle system that has recently demonstrated that space ventures involve a relatively high level of irreducible risk. A privately financed Shuttle venture would represent the barometer, if not the entire environment, within which future projects are judged for years to come.

Accordingly, both the Government and the private venture involved in the financing must be able to bear the harsh scrutiny of the investment community and must meet most, if not all, of the following criteria: first, the package must be financially sound and must demonstrate an acceptable return on equity; second, the government repayment guarantee must be firm and unassailable by a future Administration or Congress; third, pricing for launch services to the future commercial customers upon whom the return on investment depends, must be immune from political or budgetary considerations that would dilute the "back-end" of the deal; fourth, Astrotech, or another private firm responsible for the deal must be in sound financial condition, because it is upon their stability as well, that the hopes and expectations of conceivably millions of private investors would ride; and, finally, Government policy in general must remain consistent enough that it will not represent an unacceptable risk to investors, now or in the future. The Government must be willing to mortgage its ability to change policy tomorrow, in return for an attractive financial fix today, a commitment that is integral to the future provision of privately funded space services to the Government on a long-term basis.

Indeed, the real question is not whether the private sector is capable of providing the funds to purchase a new orbiter. Rather, it is whether or not the Congress and the Administration are willing to use the high-profile, expensive example of a privately financed Shuttle as the test-case for a long-term Government commitment to a stable industrial space policy -- one that includes viewing the Government as a reliable market for privately funded space services. A privately funded alternative that may be attractive on its economic merits must also rely upon a critical interagency policy consensus as well as a multi-year, multi-billion dollar legislated leaseback commitment. If such a consensus is thought to be achievable in the current political and budgetary environment, we would encourage this exercise to continue. If it is not achievable, then the current pressing demand for replacement capacity must not be allowed to drive an ill-conceived and divisive federal policy commitment to the private sector.

Thank you.

Mr. **Nelson**. In light of your comments, you know we've heard press commentary about that the STS is not an operational system now, that it's still in the research-and-development phase. In light of what you just said, are investors going to invest in that kind of system?

Mr. **Meslin**. I think that if faced with the prospect of an unequivocal commitment on the part of the Federal Government, that the investment community might be effectively enticed to participate. Their participation would be on the basis of a Government guarantee, and not on the basis of a perception that the shuttle system is operational and that the relatively high level of irreducible risk has been alleviated. So the short answer to your question is that they probably would be prepared to invest if the Government made the deal right.

Mr. **Nelson**. OK. But now this is to all of you. The real return on the investment as I have understood it as being posed is not on the leaseback from the Government, the real return is on the goodies that they would get out of it as a result of an aggressive marketing campaign; is that correct?

Mr. **Bliven**. That's what was proposed.

Mr. **Nelson**. OK. And yet NASA is the one that does the operation and the control of it, so is the investor sufficiently attracted to put its money under those circumstances?

Mr. **Bliven**. I believe that if the lease was structured as I think Mr. Rockwell proposed, that that lease could be marketed in and to itself.

Mr. **Simonoff**. I would agree. I would say that given a Government guarantee and given other quote "fences" to protect the investor and the lender, you could probably market the lease. However, I feel very uncomfortable about demonstration financings. The reason for this is if the economics are unattractive compared to competitive activities and the financing fails, it then creates a bad rep for any—for future financings. If the transaction is properly fenced and is attractive to investors but economically doesn't make sense, then I'm willing to bet a subsequent legislative review and subsequent legislation that will prevent future financings from taking place.

A good example of a financing-driven business which was unsuccessful was the purchase of boxcars some years ago, where people were buying boxcars because it was driven by taxes, tax shelters. Yet there was little final demand or—for the increased number of boxcars, so people lost a lot of money. This is the thing I don't want to see happen. I want to see space grow and have a clean reputation and have investors come in for all the right reasons and not get stung.

Mr. **Meslin**. I think that, yeah, I agree with Jerry, I think that's the main point. What we're doing here in considering this initiative is considering the establishment of a precedent which will clearly be more significant to the development of the commercial space industry than any that has been established previously, and than any that I can imagine being established in the foreseeable future. I mean in 1985 according to our research the equity markets in terms of initial public offerings were responsible for about $8 billion, $8.1 billion. Only 6 or 7 percent of this was in high-technology ventures, broadly defined. So what we're talking about here, if it—in terms of the portion of the deal that would be equity as opposed to debt, is an investment that would represent twice as much money as was invested in all high-technology ventures, initial public offerings, in 1985, and that kind of precedent, given the position that we find ourselves in with respect to the commercial space industry, would be extremely significant to the future of that industry, and that's why my point was that this isn't an issue of private financing, it's an issue of Government policy commitment.

Mr. WALKER. Mr. Chairman, I think Mr. Simonoff and Dr. Meslin have made an excellent point here, and I think that no one here wants us to end up selling capacity that's not needed and ultimately then sullying the entire investment load, but again that's somewhat of a policy decision, it seems to me, I hope you would agree with me, that one of the policies that we—that we basically have come to a conclusion on the subcommittee is indeed we need the extra capacity, that fourth orbiter is absolutely essential to virtually everything that we want to do in space in the future, and around this subcommittee you can make a good case for a fifth orbiter, at least with the majority of the subcommittee. We've got a few dissents on that, but with the majority of us we think—we think a fifth one out there, but at least the fourth one is absolutely essential in the national interest, so it—so from that standpoint I think that the financing makes sense from the standpoint of usability, but that's essentially a policy issue, would you agree?

Mr. SIMONOFF. Yes—I don't want to overpower the mike—the real issue here is as I say in my testimony I say if it is decided. The decision to get a fifth orbiter is not a financial decision, it's a budgetary decision.

Mr. WALKER. Sure.

Mr. SIMONOFF. The only thing I'm advocating is that Mr. Rockwell be given a chance to come up with a package that makes sense, and that we are not—we don't have to complicate the procurement process by having a complex financing—the argument over a complex financing delay the procurement of the orbiter. It's not necessary, and fortunately in financing—in the financial world we have the ability to keep reworking and we have flexibility to replace. This is incidentally—is a sort of strategy that I've always felt is the way you buy a satellite, is you get a core financing structure to build the satellite and this core financing will go through the life of the particular satellite, and then once the satellite is launched, you look for opportunistic ways to reduce the cost to refinance it, and you keep doing this on and on, and we really got the same thing here, your core strategy is the Government procurement with the opportunistic things as Mr. Rockwell's proposal.

Mr. WALKER. Thank you.

Mr. BLIVEN. I would—I'd like to if I may say one thing, because it seemed there was some question. I said that the lease as I understood could be done. The lease as I understand it would be that there would be a firm contract with somebody to build a shuttle, whoever the builder is, at a firm price, that that vehicle would then be leased to NASA on a full-payout lease, what one would call a dry lease, no responsibilities on the part of the person leasing it to NASA, all responsibilities would be for the part of NASA, they would pay the monthly rental or whatever the rental is, they usually structure it as monthly rental, and under those circumstances the investor in that lease would not be in a position to lose money.

Mr. **Walker**. That's my understanding of what we're talking about, and we might have Mr. Griffin confirm that.

Mr. **Bliven**. I just wanted to make sure, I was——

Mr. **Griffin**. Yeah, that's exactly right. Picking up too on something that you said, Mr. Chairman, I—just to make sure, there are really—we're talking two investors here, one is the investor in the lease, the sale lease deal. The other is in that's completely a separate apart, although it gets connected back at General Space, those are separate, or they could be the same, but it's a separate investment than those people that would invest in General Space.

I think what Dr. Meslin is getting at is a good point. I think the measure of whether a commercial space venture is successful or not would be measured against General Space's performance in the marketing arena and in what we do rather than the sale lease agreement. That's more or less in my thinking kind of a built-in once made the investor is protected and that one's not gonna—as we said earlier, I don't think that one has the risk of failure. We probably—General Space would be more on the spit with our own private financing to prove to investors that we can make a go of the marketing which we have said that we would step up to do.

So I think there's a—it's important to keep those two separate, although they are linked, because we are—we are interested in having as robust a space program as we possibly can, so that's our initiative to market it. I'm not sure I said that as clearly as I thought it, but that's what I meant.

Mr. **Walker**. I understood it.

Mr. **Nelson**. A word means what I say it means.

All right, let me ask the panel, what do you think your investors would consider as a reasonable rate of return on their investment?

Mr. **Bliven**. You go ahead, lease expert, you take it first.

Mr. **Simonoff**. I'd love to give you a lease quote. Unfortunately I can't, but I—because the numbers are quite volatile over the year. I would guess that the debt rate for the—if it's commercially raised that even with a Government guarantee the debt rate has got to be higher than the Government borrowing rate, and the reason for that is that this interest would be taxable by local authorities. The cheapest form of financing would be Government borrowing with selling tax benefits, because then at least the State authorities don't tax the interest from Government bonds. So it would be—so the—what the rate of return that the equity investors would get I can't tell you right now because the number is tremendously volatile as to when in the year you go. If you tend to go for equity toward the end of the year when there's competition with a great deal of other taxable-year activities, the rate of return can swing 5, 10 percent higher, so I'm gonna have to duck the question.

I will say that the effective lease rate cost to the Government is going to be, I'm willing to bet, the quote indicated rate will probably be somewhere around 4 to 5 percent less than the Treasury bill rate, but when it's all in and all the tax revenue denial comes in I don't know, it may be a little bit better for the Government and it may not, I don't know. That's what Mr. Rockwell should show when—what his investment bankers should show.

Mr. **Nelson**. You're saying that the what is 4 to 5 percent less?

Mr. **Simonoff**. Sir?

Mr. **Nelson**. You said what is 4 to 5 percent less than the going Government——

Mr. **Simonoff**. Than the debt rate. Yeah.

Mr. **Nelson**. You're talking about the going Treasury bill rate.

Mr. **Simonoff**. Yes; it could be. For the equivalent maturity. In other words, if it's a 10-year lease, I would go against a 10-year or series of fixed Treasury obligations that'd be there. That number is wild, soft, you have to see what the market is, when in the year it is, it is generally lower.

Mr. **Nelson**. And you said it is less because of why?

Mr. **Simonoff**. It is less because the overwhelm—in the—the overwhelming amount of the rental paid is used to support the debt that the lessor has raised; to the extent that the lessor has raised less debt than the cost of the shuttle because he sold the tax benefits or because other people are taking risks past the amortization, you're getting $2 billion worth of shuttle supporting $1.5 billion worth of debt. So that's the equivalent of borrowing some lower-priced debt for the $2 billion shuttle. It's—that's again we'll let—I would let Mr. Rockwell's investment bankers give you the scenarios on that.

Mr. **Nelson**. OK. Now since you are a panel of experts, tell me what guarantees do you think that might have to be here by the Government in order for this deal to make it.

Mr. **Bliven**. Firm lease, a firm lease from the U.S. Government.

Mr. **Nelson**. That's it. Firm lease for 15 years.

Mr. **Bliven**. And they are—it's lease to them, there are no responsibilities over on this side of the fence.

Mr. **Nelson**. Say that into the microphone, because I can't year you.

Mr. **Bliven**. Pardon me. I said a firm lease for a fixed dollar amount from the U.S. Government, that the U.S. Government assumes all risks of operation.

Mr. **Nelson**. All right, you don't have to worry about ancillary factors such as the right of first refusal in the event that the entire shuttle fleet were to be financed. You're saying no and Mr. Simonoff's sayin' yes.

Mr. **Bliven**. For once—for a change.

Mr. **Nelson**. You don't have to worry about things such as Government bumping rights in the case of a national emergency.

Mr. **Bliven**. No, sir, the obligation——

Mr. **Nelson**. You're talking about firm lease.

Mr. **Bliven** [continuing]. To pay the lease is the obligation to pay the lease, whether or not the shuttle flies, whether it's full or empty.

Mr. **Walker**. All of those things would be a problem for the marketing arrangement, right?

Mr. **Simonoff**. That's right.

Mr. **Walker**. In other words——

Mr. **Simonoff**. Correct.

Mr. WALKER. In other words they're no problem on the lease, but they would be the problem in your marketing arrangement; is that correct?

Mr. BLIVEN. That's separate and—the marketing arrangement is separate and apart from the lease.

Mr. NELSON. Separate, separate deal.

Mr. SIMONOFF. That's why the lease is in essence a low-cost proxy for Government borrowing, just another form of de facto debt.

Mr. NELSON. All right, would you all go into this without a marketing arrangement? Would you look at this as two separate arrangements?

Mr. GRIFFIN. We look at it as two separate arrangements, but we think they're linked, and the answer is, frankly, I don't know. I don't think we would.

Mr. WALKER. Well, the—if I might, Mr. Chairman——

Mr. NELSON. Sure.

Mr. WALKER [continuing]. The point being that—that you want—that you're not a leasing company, as such, and what you want to do ultimately is have then a profit side of all of this that essentially you're looking at the lease arrangement as being kind of a wash for you, but that your profit comes out of what you're able to do as a company, and so that—so that the marketing side of it is the question of your profitability, isn't that——

Mr. GRIFFIN. That's correct.

Mr. WALKER. And so the linkage—the linkage that is implied there is to assure that you have some—some mechanism that ultimately has a chance of increasing your profitability.

Mr. GRIFFIN. Correct.

Mr. MESLIN. If I may interject for a moment, that's when the issue of rate of return becomes extremely critical, obviously. The rate of return that an investor comes to expect in going into this deal must be a function of the profits that he expects to obtain through participating in the marketing activity as well, and that's when the bumping rights and the other things come into play. And that's what I was referring to primarily when I was talking about the consistency and longevity of Government policy in this regard. Can the Government make that kind of commitment and expect it to stand up for a decade?

Mr. NELSON. All right, now—now you would be seeming to say, Dr. Meslin, something contrary to what Mr. Simonoff and Mr. Bliven are saying where they're talking about the lease stands on its own as far as attracting investors and you're saying well, that may be so, but the investors will be—it'll be sweetened a little bit if we have all these other goodies in the marketing arrangement. Is that right?

Mr. MESLIN. That's correct, yes, I don't think that—I was going to say that I don't think that the lease obligation on its own will necessarily represent as attractive an investment opportunity as a package, and that many investors may participate—choose to participate in both or neither on the strength of the marketing commitment and so forth.

Mr. WALKER. But there would be differences in the investors on who they are. There would be—there would be investors in the leasing arrangement and then there would be investors in General Space Corp. that—and the profitability would come to the people who have bought stock in General Space Corporation, isn't that the difference here? And the rest of the people in the leasing arrangement——

Mr. **Simonoff**. There's two different issues.

Mr. **Bliven**. We have two different——

Mr. **Walker**. Yeah, as I was going to say——

Mr. **Simonoff**. Let's take'em one at a time.

Mr. **Walker**. Yes.

Mr. **Simonoff**. One at a time. The—in—on the equipment lease, on the vehicle lease itself, the pricing, the three elements of the pricing, one is the going interest rate, and we'll forget about that, that's out of control. The second is the tax benefits available. And the third is the perception of incremental profitability above those tax benefits. Those are the three issues. It's only that third issue. The first two alone will enable the financing—will most likely, given all the fences, enable the financing of a lease. The third, if this were a shorter term lease that the debt were paid off earlier. There would be a greater sensitivity in the amount of equity you could raise to the Government policies, because you're talking about 15 years or I think you need a minimum of 11 for the—a minimum of about 13 years, excuse me, somewhere in that order, because you're so far out in the future I doubt that any investor is going to make an 11-year bet on a piece of equipment that's getting pretty old by the time he's in the residual phase of the financing. So I—while indeed the policy will affect the pricing, I—my gut is that it will not significantly affect the pricing. Now I guess you could answer the one on the company.

Mr. **Meslin**. Well, you're the expert when it comes to the lease terms, and as far as the—you know, if institutional or other investors come to regard the investment in this lease obligation the same way as they would regard any other Government-backed security of equivalent value, then the assumption is that the money would be available. However, in terms of the addressability of the market by General Space over the long term, I really don't know that the investment community in general, or the public for that matter, would differentiate between the two completely, so that they would look at each deal on its merits and only on its merits. I have the feeling, and this is equally a gut instinct, that it would tend to be viewed as largely synonymous, certainly in terms of the public, and frankly it's from the public that tomorrow's commercial space ventures will come, and it's the public that has to be assured to some degree that Government policy in this regard will remain consistent.

Mr. **Walker**. And I gather that General Space wants them to be looked at synonymously, I mean, that that is essentially what they are attempting to do, is that not correct?

Mr. **Gillam**. That's correct.

Mr. **Nelson**. Mr. Samuels.

Mr. **Samuels**. I'd like to make a comment. One, I didn't realize that we were restricted solely to leasing obligations, and you can get the same benefit by having different types of debt instruments where the principal can be guaranteed so that the payment to the investor is identical as to what it would be as far as the lease is concerned. From the Government's perspective too, though, if there is no participation in a potential profit stream at some point in time, I believe that you would have to pay a higher rate at the outset than you otherwise would if you didn't permit investors to participate in some opportunity later on. I also don't believe that simply because of the Government obligation in this type of venture that you can get an even swap between equivalent T-bill rates and this type of venture. I think people would require, unless there were some sweetener at the end, a rate higher than they would for other more typical conventional Government debt instruments.

Mr. WALKER. So as I understand you, you're saying that the two-phase part of the deal that assures some profitability down the line or some profit mechanism down the line is very important to the entire deal.

Mr. SAMUELS. I think it's in everybody's best interest, including the Government's.

Mr. NELSON. And I think it's important to make this point here raised by Mr. Samuels. He did not necessarily know that it was restricted to the sale lease back provision. Nor do we approach this hearing in that manner, because the solicitation put out by NASA has brought forth a number of proposals and only one that we're discussing here today, which happens to be the suggestion of a sale lease back. So let's don't get ourselves confined just to that.

Mr. SIMONOFF. Sir?

Mr. NELSON. Yes, sir, Mr. Simonoff.

Mr. SIMONOFF. If you look at the NASA proposal, by virtue of the NASA proposal not allowing the pass-along of capital costs to the user in the pricing, it almost—at least my feeling was that it dictated a lease, because where the benefits, the capital benefits were from the user's standpoint was the—excuse me, from the investor's standpoint was the tax benefits, so that's the most logical form of a structure.

Mr. WALKER. Do any of you from the investment community want to suggest to the committee at this point some other kind of arrangement that might also be attractive that gets us to the same place the leaseback does but, you know, could sketch for us a scenario that some other set of investors might like to consider to do approximately the same thing?

Mr. SAMUELS. Well, the proposal that I suggested as far as a zero-coupon convertible bonds is concerned and/or as Dr. Meslin mentioned, an annuity, and this could then be structured depending on what specific arrangement was made as far as the private corporation was concerned in its dealings with NASA as to which specific function or functions it wanted to assume as part of its operation.

Mr. WALKER. But in that case NASA could—it could still be the sole operator of the system——

Mr. SAMUELS. That's correct.

Mr. WALKER [continuing]. And you have offered a potentially different financing mechanism.

Mr. SAMUELS. Yes.

Mr. NELSON. Well, what do you think about the reasonability of what NASA announced this January for preliminary discussions with private investors, the terms and conditions?

Mr. Bliven. I think the question you are dealing with is whether or not the risk-sharing proposals that I can put up on the board are the proper proposals to go forward. If he is willing to—or NASA is willing or you're willing to say that you think that this type of financing is the proper type of financing, if there are reasons why this is a desirable type of financing for the Government to go forward with, he would have to answer whether or not those—that fit his risk criteria or change his risk criteria, and I think probably you need to address that question to Ike, if he's still here.

Mr. Gillam. Still here, unfortunately.

I would have to say that—that conceptually without just based on the concepts that I've heard that—that the concepts, all of them, would meet our risk criteria to much more of an extent than any proposal we've seen to date, and that we could be made comfortable with those—with further discussion and further pursuit and a little closer look at what they really mean in terms of numbers.

Mr. Nelson. You know what I think is really gonna complicate this whole situation is the question of the ELV's and how you draw a marketing package that's going to allow you to market the shuttle and/or ELV's, and how you get all of that started with an American ELV that can compete with the foreign competitors. Now that just begins to sort of fuzz up my mind when I try to think of all that.

Mr. Gillam. Mr. Chairman, I had thought till a few seconds ago about pushing my microphone and bringing up that question, but I didn't want to mess up the hearing.

Mr. Walker. Ike, just let me follow up with you. Some of these other arrangements that we've just heard discussed here in terms of financing arrangements different from that which Astrotech, General Space has brought forward, would they involve the same kind of policy changes that we talked about before being needed on Capitol Hill?

Mr. Gillam. Legislative authority, probably.

Mr. Walker. Legislative authority.

Mr. Gillam. Yes.

Mr. Walker. All of them would be about the same.

Mr. Gillam. We've generally come to the conclusion after scouring the Space Act that any kind of arrangement like this would require some type of authority on the part of either the authorization, appropriation or both committees.

Mr. Walker. I'd like to say in my mind that my answer to the chairman is that you know when I look at the space-access questions, and I begin to contemplate some of the things we've heard today about maybe reduced flight rates for shuttle coming out of the Roger Commission—Rogers Commission recommendations, I think there's going to be plenty there to do, both ELV's and shuttle, I mean the bottom line is how much traffic do you think is gonna be in space in the early nineties. Now how much access capacity are you going to need, and my guess is that there is going to be a good bit, that we are going to need that mixed fleet well into the next decade, and that we can probably sustain a commercial effort on both sides. If we don't believe that, then I can buy where the question comes from. On the other hand, if we think that there's going to be a good deal of capacity needed, it seems to me that the most aggressive stance possible to get as many private entrepreneurs into the business as possible is probably in the long-term national interest of the country.

Mr. SIMONOFF. Just to financially support what you're saying, the worst thing that you—if you're buying a satellite, the worst thing that can happen to you is to have a launch delay. You're better losing it and having insurance than a launch delay, because the interest keeps building. So—it was some time ago and people were looking at the cost of a expendable backup of a shuttle. This is exactly the type of thing where it can help financially enormously to have this and you can literally pay for the cost of holding these reserves by the launch-delay insurance or a quote "de facto" type of launch-delay insurance.

Mr. WALKER. And we can bet that if that started to materialize that we would find people that would build compatible loads so that they could be assured that they could go into the competitive marketplace with compatible payloads.

Mr. SIMONOFF. That happens now.

Mr. WALKER. Sure.

Mr. BLIVEN. I mentioned that—pardon me—I mention that in my talks and just to get perspective on it, let's assume somebody was going ahead with a space platform—the Fairchild one was brought up—I believe that in its original phase that cost about $250 million, did it not? If that thing were ready to go today and it were going to be delayed 2 years, somebody's gonna have to eat some $50-odd-million, and I want to assure you that in my earlier life as a banker that unless somebody's picking up that risk, I ain't makin' that loan.

Mr. GILLAM. Mr. Chairman, there's another aspect to that—that's an extension. Let's not assume it was ready to go today, let's assume this is 1994 and it's up there, and we face a 1-year period where the manned capability is unable to support it, that is a severe threat to commercial activities in space that we should start to think about.

Mr. NELSON. All right, let me ask Dr. Meslin, on page 3 of your testimony you said, "* * * increased reliance on ELV's for commercial satellite missions would be ironically short-sighted."

What do you mean by that?

Mr. MESLIN. I knew you were gonna spot that. Allow me to answer—make a comment on the previous remark. I think that if we look at aggregate launch requirements over a certain period of time that clearly there is enough to go around, both in terms of four orbiters and a complement of expendable launch vehicles. But if we look at the particular payloads that are likely to be carried, a proposal such as that presented by Astrotech or such as what would be anticipated by another firm relies to a significant degree on access to commercial payloads, communications satellites in particular. Expendable launch vehicles are primarily useful in carrying communications satellites. Therefore, if that portion of the market that is accessible to commercial ELV's were allowed to be carried by the ELV's, it would result, I believe, in a shortsighted policy, one that would cause higher—produce higher launch rates for the commercial communications satellite industry, probably translate into decreased revenues for the U.S. Government in terms of the commercial communications satellite revenues, which help to offset shuttle operating costs. And finally, it's a technology that we would be required to make an investment in a technology and in supporting infrastructure such as the upgrading of the launch facilities, maybe $30 or $35 million in that alone, that I don't think would be tenable in the long run.

Now in addition to the fact that ELV's for their subsistence and success would have to rely on the commercial communications satellite market, you would at the same time be removing that portion of the market from the arrangement that Astrotech or someone else had proposed, or if not removing it, at least limiting access to that market by encouraging a competing segment to the industry that needed to rely on that share of its—on that market for its own survival. In other words, you would be decreasing to some degree the attractiveness of a leaseback and marketing arrangement for a new orbiter, in our opinion, because what you would be doing is restricting the available—the market that was available to Astro—or to General Space to go after, because at the same time you would be encouraging a competing industry who had only that market to rely on for its success.

Mr. WALKER. Well, I guess I have some question about whether or not that is the only market, I mean, remote sensing lends itself to ELV's as well.

Mr. MESLIN. Yes; that's true, but in terms of the—I mean, we probably don't want to reopen the shuttle pricing policy debate at this juncture, but in terms of the relative costs of the phase 3 shuttle price versus the projected costs of the Atlas Centaur or Delta launch vehicles, it seems clear that commercial users of those expendable launch vehicles would effectively be penalized by flying on them because they would experience higher costs.

That goes for the remote-sensing people as well as for the communications satellite owners, and the question then becomes: Are there enough remote-sensing payloads or enough commercial satellite payloads in the aggregate to support both of those launch systems?

Mr. WALKER. Yes; I understand what you're now saying. One suggestion we've had to offset that problem, though, would be, for instance there are certain scientific payloads the Federal Government flies that are ELV-compatible. If you gave four of those to an ELV operator each year, thereby reducing his costs of operation, and you know the economy of scale was built into the system, he in fact probably could become competitive even within the present shuttle pricing policy, and you know that's one of the things that we may want to look at, is a way of balancing that and assuring that you had that kind of a mixed fleet.

Mr. MESLIN. I believe that Mr. Lovelace in his testimony last week before this subcommittee indicated that based on the assumption of flying two to four Atlas Centaur launch vehicles per year, the cost would be in the neighborhood of $65 to $74 million per launch, and that an Atlas Centaur launch vehicle represents perhaps half the capacity of an equivalent shuttle payload bay—of a shuttle payload bay. So I don't know whether those economies would result in competitive prices to commercial customers.

Mr. WALKER. That's one of the things—I think we came out of that hearing saying that we were certainly gonna have to look at it.

Mr. MESLIN. Right.

Mr. NELSON. What additional information should investors have other than what you heard today in this proposal outlined by this particular private entrepreneur? What specific information would your investors want to know in order to be potential investors?

Mr. SIMONOFF. Mr. Bliven reminded me, I forgot that—we have to add one more thing, that's the stipulated loss—if the shuttle crashes or that the lease payments must still be made or—and there must be some tax indemnity in case there's any tax recapture.

Mr. NELSON. In the case of a loss.

Mr. SIMONOFF. Yes.

Mr. NELSON. OK.

Mr. SAMUELS. Excuse me, could I——

Mr. NELSON. Mr. Samuels.

Mr. SAMUELS [continuing]. Get one clarification, and that is, as far as the ELV question is concerned, are we talking about a modest supplement to the shuttle capacity, or are we talking about promoting the industry as a separate entity?

Mr. NELSON. Well, I don't know the answer to that, but it might well be the latter. That complicates things, doesn't it.

Mr. SAMUELS. Well, it changes the perspective on the part of the investor, and then it becomes a market decision on the part of the investor as to what he feels is the dominant technology or the technology that can see—can succeed or whether in fact that's an issue.

Mr. GRIFFIN. Mr. Chairman——

Mr. GILLAM. Excuse me.

Mr. GRIFFIN. Go ahead.

Mr. GILLAM. Mr. Chairman, I was going to say that there are a substantive amount of people around that believe it's the latter.

Mr. NELSON. Including Dr. Graham. Is that what you're talking about.

Mr. GILLAM. I didn't say that, sir.

Mr. NELSON. Now when you're sayin' the latter, you're talking about what I was talking about, the latter.

Mr. GILLAM. Yes, sir.

Mr. NELSON. The expanded ELV industry.

Mr. GILLAM. Yes, sir.

Mr. NELSON. Dr. Graham's already said that basically in front of this committee.

Mr. GILLAM. I didn't recall that, sir.

Mr. NELSON. About 2 weeks ago.

Mr. GRIFFIN. This is a little out of place, although related, but I'd like just for the record to clear up one point that when General Space is talking about marketing both shuttle and ELV's, we are talking about Government ELV's, we're not talking about trying to market all known ELV's that—built in the United States, and that is somewhat in respect to something that you said earlier, that you could have industrial entrepreneurs who wanted to go into the ELV business and be competing, if you will. The way I envision this, and this has not been fully discussed, at least in my presence, yet, because of my newness to this, but it seems to me that if you're gonna have a marketing entity that is trying to promote and sell shuttle and Government ELV's, you can mix the—you can look at that mix and actually offer the customer the best deal, and it makes a coherent picture for the Government to deal with. Now that is not restrictive.

Mr. **Nelson**. What are the Government ELV's, because they're basically dryin' up?

Mr. **Griffin**. Well, yes, they are, and—but we're not sure that that's gonna—that will depend on probably these hearings and others in the SIG in results and we may not—we don't know yet where the ELV picture's gonna wind up. But my major clarification there for the record is that we're talking about the Government ELV's.

Mr. **Nelson**. Yes; so you want to defer the questions about how much up-front cost would you have to have to start up an ELV line and who would pay for it and all of that?

Mr. **Griffin**. Yes, we'd like to not address that.

Mr. **Nelson**. Well, somebody has to. I guess we'll have to do that.

OK, is there anything other for the good of the order here in trying to sort all of this out? Anybody want to share anything more?

Mr. **Bliven**. No; but if you have any questions or care for any information, don't hesitate to come back at us.

Mr. **Nelson**. Oh, we won't hesitate. And if you think of any other thing that any of these four entrepreneurs should flesh out when they make their proposals to NASA which would be absolutely essential as far as interesting any of your investors.

Mr. **Samuels**. One thing I think that probably needs some clarification, and that is there's been mention of specific investment bankers and their assessment of the market and their abilities to raise a certain amount of capital. I think it might be necessary to know what they're basing that statement, meaning the investment bankers, on what expertise they have a knowledge of the specific market that they have to raise funds for this particular type of venture.

Mr. **Nelson**. Well, thank you. Mr. Grimes.

Mr. **Grimes**. We appreciate the rescheduling opportunity, and we are very appreciative of having the opportunity to discuss with you today America's assured access to space.

We have filed a full statement with your committee staff, but in the interest of time, we would like to just summarize our remarks.

All of us share the concern about the recovery of our Nation's space transportation industry in the wake of the terrible shuttle tragedy. We all feel the deep loss for the seven brave astronauts who gave their lives on Challenger. We will not forget the importance of the contributions they made in establishing the human presence in space. They had a vision of man's future in space that we all share, and to that end we strongly support a replacement orbiter to continue that pushing back of man's frontier in space.

However, as we move forward to reestablish our space transportation industry, I think it imperative—and I think you have pointed that out many times today—that we proceed with cool, deliberative, reasoned actions that have become a hallmark of the Nation's space program.

With respect to my company, Transpace Carriers, however, Mr. Chairman, I can assure you that we are totally committed to maintaining American leadership in providing ELV launch service.

It was my privilege for 19 years to be a member of the NASA team. During the last 5 years of that tenure, I served as Delta project manager. During that period, the excellent NASA industrial team conducted over 30 missions, 30 successful missions which we were quite proud of.

When the opportunity came to commercialize the Delta back in 1982, a group of my colleagues and I formed Transpace Carriers to attempt to bid on the commercialization process. We were successful in that, as you are well aware, and we went under agreement with NASA in May 1984 for that commercialization activity.

What we have now today is a preliminary commercialization agreement which we spoke of, or the last person to testify spoke of, Madeline Johnson. We are now in the final stages of going through the negotiation of the definitive agreement. We had a meeting, a very successful meeting, with the group this past Monday, and we seem to be on the verge of having a signed definitive agreement. We had a meeting, a very successful meeting, with the group this past Monday, and we seem to be on the verge of having a signed definitive agreement. A couple of things are outstanding, and we will cover those at a later point in the testimony.

The period from May 1984 through August 1985 was a period of immense frustration for us all, for our company, at least, in that we were confronted with having to generate a group of financing. Before I go into that point, when we came out of the May 1984 agreement, we put together a $22.5 million package with CIGNA, Connecticut General Life Insurance Company, and Bank of America to finance the startup of the company.

However, we ran into some problems with customers not wanting exactly the guarantees that we had put in place with NASA backing to guarantee us through 1986; they wanted to be guaranteed through 1987. So we brought in First Boston Corp., a New York investment banking house, who arranged for a set of guarantees and additional capitalization to provide those guarantees for the customer base.

Then we got into the shuttle pricing issue, and it was not clear whether commercial space transportation was going to survive or not, and that extended out through August of last year. In August, the decks were clear at about a 45-day dwell period where we understood the pricing issue, and we saw that commercial space transportation could in fact exist under that shuttle pricing policy.

Mr. Nelson. Under the new price?

Mr. Grimes. Under the new pricing policy, that is right, because what you ended up—what has happened is that you have got three options. You could charge high, charge low, or you could charge low with a reduced marketplace, and you limited the marketplace of shuttle, which gave the commercial guys a chance of making it.

So at that point in time, my company had spent $5 million in setting up this activity. We have raised a total to date of about $33 million. We have brought financing to bear on this company in that amount. We are currently moving into the marketplace. We are in the marketplace for additional financing of amounts sufficient to finance this company, and these amounts are in the order of an additional $35 million. I would be glad to give you a detailed summary of those numbers in private.

But the point is that the financial marketplace has already indicated their support of commercial space transportation, and that was even before the shuttle pricing issue. After the shuttle pricing issue, it would now appear that it is much more available to us. What we need is a clear statement from your committee here and from the Congress that, in fact, the Congress does support the commercial space transportation industry in the United States.

I think, with that clear statement, we will be able to finalize our financing package that is now under way, and we will be up and running in the next few months.

[The prepared statement of Mr. Grimes follows:]

STATEMENT OF
DAVID W. GRIMES
PRESIDENT OF TRANSPACE CARRIERS INC.

BEFORE THE
SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS
COMMITTEE ON SCIENCE AND TECHNOLOGY
UNITED STATES HOUSE OF REPRESENTATIVES

MARCH 20, 1986

Mr. Chairman and Distinguished Members of the Subcommittee:

I appreciate this opportunity to discuss with you today how the private sector can help fulfill our nation's space transportation needs following the tragic loss of the Challenger Orbiter and her brave crew of astronauts. Since our company, Transpace Carriers, Inc. ("TCI") has been preparing to offer a commercial space transportation capability using the Delta Expendable Launch Vehicle ("ELV"), I will direct my remarks to how TCI's operations could complement the Shuttle fleet's unique capabilities by providing "Delta-class" satellite users with an available American alternative to foreign space transportation systems.

I served as NASA's Delta Project Manager from 1977 to September 1982. During that time we conducted over thirty (30) successful Delta launches for NASA, and I developed a great respect for the Delta's reliability and flexibility and for the straightforward manner in which the Delta system operated. When NASA announced in August 1982 that it would terminate the Delta Program in 1986, I decided to resign from NASA to form a commercial company that would carry on Delta operations in the private sector. I believed that the highly developed capabilities and future potential of the Delta should not be thrown away, and that there would be a significant market for commercial Delta launch services. I left NASA in September 1982, established TCI and gave NASA a preliminary proposal to commercialize the Delta Program on September 27, 1982.

Following the May 1983 decision directive establishing that it would now be Government policy to commercialize Government ELV's, TCI responded to NASA's September 1983 public notice in Commerce Business Daily requesting solicitations to commercialize the Delta Program. TCI was selected, entered negotiations with NASA in January 1984, and reached agreement on the terms for beginning that transition process a few months later. NASA officially executed this agreement in May 1984, and TCI has been moving forward under this agreement since then. Negotiations with NASA to finalize all the terms to complete transition of the Delta Program are in the final stages.

TCI will use the Delta ELV to provide a complete space launch service to Delta-class satellites. The Delta is currently capable of placing a spacecraft weighing up to 2,800 pounds into the geostationary transfer orbit ("GTO"), and it can place spacecraft weighing up to 6,700 pounds into a low earth orbit. The Delta also has a long history of launching spacecraft into earth escape orbits, and can launch approximately 1,600 pounds into such an orbit. The Delta's most frequent use has been to launch telecommunications satellites into GTO, and it has also been employed to launch earth remote sensing, weather, and scientific research satellites into either GTO or other orbits. TCI expects to continue launching the same types of satellites as a commercial enterprise, and will obtain the majority of its market from launching telecommunications satellites into GTO.

The Delta has achieved an extraordinary reliability record during the years that it has evolved from its original GTO capability of about 100 pounds to its currrent 2,800 pound capability, proving so successful that an entire class of satellites, the "Delta-class", was designed specifically to take advantage of its capabilities. It has a lifetime success record of 93.8% (166 successes out of 177 launches), but has improved this to 97% over the last 11 years (75 out of 77) and 100% over the last 8 years (43 out of 43). TCI will continue to maintain all of the standards of reliability and quality assurance that have resulted in Delta's unparalleled reliability record.

TCI plans to continue the carefully phased evolution of the Delta's capabilities as necesary to meet any growth in its customers' requirements. Current plans call for gradually upgrading, as needed, the maximum weight a Delta can launch to approximately 4,200 pounds into GTO by 1992, and also for increasing the maximum allowable payload diameter to ten (10) feet in the same time period. These planned improvements will increase the Delta's low earth orbit capability to more than 10,000 pounds. The Company will examine the development of a rendezvous and docking capability for possible Space Station resupply missions if such missions appear likely, and does not expect required improvements to be unreasonably expensive. These improvements are actually an evolutionary step for the Delta rather than the development of a whole new capability. The Delta's current second stage already has a restart capability, and the addition of the guidance necessary to carry out rendezvous and docking maneuvers is well within current Delta capabilities.

TCI's present plans call for the initiation of Delta vehicle production in April in order to minimize the time before its first vehicle will be ready for launch. By using the existing components and materials that are available in the

Delta Program to complete the first three vehicles and by completing other vehicles as rapidly as possible, TCI can have its first two (2) launches prepared to go in September and November 1987, four (4) in 1988, seven (7) in 1989, ten (10) in 1990, and as many as twelve (12) per year after that. This planned launch availability was recently verified with McDonnell Douglas Astronautics Company ("MDAC"), the Delta's prime contractor, as being the best attainable if they commence production efforts in early April. This schedule can be accelerated slightly, but only at substantially increased costs. The long lead-time to build up the Delta's launch rate is caused by the very long manufacturing times required for various components that are not currently available.

The Delta vehicle can be "tailored" to a high degree to meet the requirements of individual customers because it can be launched in a number of different configurations. TCI currently lists eight (8) possible models that a customer can choose from, so that a customer may purchase only as much vehicle capability as needed for its requirements. Smaller satellites can be launched by less expensive models of the Delta than are necessary for larger satellites, and they will thus pay less for their launch services than the larger satellites. Since the Delta can be more finely tailored to the needs of its customers than can the Ariane, TCI expects this ability to be an advantage in the marketplace.

The Company will price its launch services on a commercial basis, and anticipates pricing its top-of-the-line capability vehicles at approximately $35 Million per launch (in 1985 dollars). This is a single launch price that includes all standard services and the upper stage. Quantity discounts may be negotiated. In the event that TCI were requested to launch a Government payload, these prices would be subject to adjustment to take into account any Government facilities or property that were used in the launch. Should any Delta-class satellites currently manifested on the Shuttle desire to be switched to TCI's Delta, the savings in terms of potentially advanced launch dates are expected to offset to a considerable extent, perhaps totally, the difference in costs between a TCI and a Shuttle launch of the same satellite. Many Delta-class satellites, especially those scheduled for launch in 1988 and beyond, can be easily switched to TCI's Delta at little or no additional cost for satellite modification.

The Subcommittee has requested TCI's views on how best to meet America's space transportation needs following the Challenger accident. TCI believes that the Orbiter fleet is an extraordinary national resource that will pave the way for the full commercial development of space later in this century and in the next. It is thus essential that a replacement Orbiter for the Challenger be procured as rapidly as possible.

The priorites for use of the Shuttle fleet, however, must be re-examined in light of the lost capacity during the period of the accident investigation and problem fixing. It is TCI's belief that the guiding principle for future use of the Orbiter fleet should be that the fleet be used for its highest and best uses first. All satellites not requiring the unique capabilities of the Shuttle should be required to look to commercially available sources of space transportation first, and, if such transportation is not available, only then should they look to the Shuttle fleet for their launch requirements. The use of such principles would insure that all payloads requiring launch by the Shuttle would have their launch requirements met in a timely manner, that the commercial space transportation industry in this country would have the opportunity to establish itself, and that the United States would benefit from an increase and a diversification in its space transportation resources.

The Delta can help alleviate some of the shortfall in launch capacity over the next few years, and TCI is planning its operations to take advantage of the maximum build-rate that the Delta Program contractors can attain. However, a question has now been raised as to whether the Government or TCI should launch Government Delta-class payloads using the Delta, in effect putting the Government into competition with TCI. Such competition is not necessary and could make it very difficult for TCI to develop its operations as planned. The Government has appropriately entered into a number of non-competition agreements with commercial companies in order to foster the commercial development of a desired program. Examples of such non-competition agreements include the ones with McDonnell Douglas Astronautics Company for the development of the PAM-D, PAM-D-II, and PAM-A upper stages and with EOSAT (RCA and Hughes) for earth resources data. Commercial attempts to develop a capability that the Government is also developing have met with, at best, limited success.

TCI believes that Government purchase of its Delta launch vehicle services can result in economies for the Government due to the savings that can be achieved in the following areas:

1. Elimination of the Government program structure for overseeing Delta production and launch operations.

2. Elimination of expenses and delays resulting from priority conflicts between competing production and launch programs.

3. Elimination of contractor expenses for monitoring and accounting for separate customer contracts.

4. Reduction in vehicle costs payable by the Government attributable to purchase from larger production runs.

5. Reduction in launch processing costs payable by the Government attributable to spreading TCI's fixed costs over a larger launch base.

TCI thus believes that the price of its launch services to the Government will be equal to or less than the Government's costs for maintaining the same capability on its own.

In addition, TCI operation of a single Delta Program will have a number of benefits both for the Government and for TCI's commercial operations:

1. TCI would be able to offer the Government a rapid response to changing Government launch requirements by the ability to switch launch vehicles between Government and commercial launches while continuing to meet all of its other customer requirements.

2. The Government would be able to utilize its scarce personnel and fiscal resources for other purposes.

3. TCI will be better able to compete against foreign launch services providers because its per unit costs will be lower.

4. The presence of a Government base of launches would demonstrate support for commercial space launch operations.

5. This demonstration of active Government support for commercial space operations by using a private sector service that meets Government requirements would encourage other entrepreneuers to undertake the risks of commercial space operations.

Several Government goals can thus be realized by purchasing its Delta-class launch services from TCI.

The Government should weigh very carefully any decision on continuing its own Delta operations. TCI entered the process of Delta commercialization on the clear understanding that the Government would not conduct any further Delta operations once its remaining Delta launches were completed (the NOAA launches then scheduled for 1986). A change in this plan in mid-1985 in order to make launches available for the Department of Defense using Delta vehicles had very severe repercussions in the marketplace for TCI. Potential customers were confused as to whether the Government in fact intended to follow through on commercializing the Delta Program and were thus confused as to TCI's status, making it very difficult for customers to commit to using TCI's proposed launch services. A further decision by the Government to continue supplying Delta launch services, even if ostensibly only for Government Delta-class payloads, would induce even greater uncertainties into the current situation.

Such operation of a concurrent Government Delta launch capability or the institution of a Government "transition" period will be interpreted by the financial and customer community as code for a reversal of the Government's ELV commercialization policy. Either action will effectively end TCI's opportunity to establish a commercial Delta operation, and will have attendant undesirable repercussions on the investment prospects for other U. S. commercial space activities. The real question that must be answered is whether the Government will now reverse its ELV commercialization policy and guarantee NASA a continued monopoly on U. S. space transportation or will it go forward with a program to put the United States at the forefront of space commercialization activities? The former represents a return to the past while the latter will build upon the successes of the past to open new frontiers for commercial development.

Transpace Carriers in prepared to operate the reliable and capable Delta system both now and for many years to come. TCI's operations can help relieve the critical shortage of U. S. launch capacity during the next few years. We have a team of dedicated NASA and aerospace professionals ready to help fill the satellite industry's launch services requirements into the next century and we will increase the capability of the Delta to place larger payloads into space as the market requires such improvements. Our financial team is in place and will proceed to finish work on and close our financial package; but it would be unrealistic to expect investors to risk the sums required to support the creation of a commercial launch industry in the United States without clear Government support in terms of releasing the necessary assets to insure success. This is the only remaining hurdle that is preventing TCI from commencing a full scale commercial space transportation operation.

I thank you for the opportunity to address these issues and I will be pleased to answer any questions this Subcommittee may have.

Mr. **Nelson**. OK, now tell me something about the competitiveness of the price of launching this vehicle vis-a-vis your competitor, the Ariane.

Mr. **Grimes**. Arianespace? I think, when we filed—we filed a complaint against Ariane back in May 1984. At that time, they had done some rather severe price cutting in the American marketplace. During the course of the year's study by the U.S. Special Trade Representative, we came to know the general pricing structure of Ariane. It conformed very much to what we had concluded to be the case before we entered this market.

We are very competitive. We were competitive when it was 9 francs to $1. Now, with the rate being at 7 francs, we feel very, very positive about being competitive; that is, being competitive on a limited subsidized base for Ariane.

When Ariane came on board back in 1981 or 1982, they were charging internally to the ESA member states about $32 million a launch. We can be very competitive with that dollar number.

Mr. **Nelson**. Does your competitiveness hinge on the value of the dollar vis-a-vis the French franc?

Mr. **Grimes**. Well, to a certain extent, but we had confirmed our suspicions that we were competitive in the marketplace at 9 francs to the dollar, and I doubt that we will see that type of ratio between the franc and the dollar again.

There are also several other competitive points to be made with respect to Delta. Delta is a single-mission service; Ariane carries two, what we call, Delta-class spacecraft. So the customer base gets a single—they own the rocket as opposed to owning half a rocket. They have a situation where they don't have to compete with other technical forces in order to have their schedule achieved and their schedule variations achieved.

Mr. **Nelson**. Staff has reminded me that I just need to say something for the record, that throughout the entire hearing today, all of the prepared testimony will be submitted as a part of the record, even though we have been conversing in an informal way, and the conversations will certainly be included in the record as well, but so will the prepared testimony.

Now, you say you need a clear statement of Government support for ELV's. Now, what does that mean?

Mr. **Grimes**. Well, as we proceeded on this path of commercializing Delta, there has been a—the President set up the Office of Space Commercialization, Department of Transportation. Congress followed with a clear statement with the Space Commercialization Act, and we thought we were well on our way.

But, subsequent to the tragedy of *Challenger,* we find that there is a mixed signal coming out of NASA and coming out of other congressional and administrative offices with respect to just how this thing is going to proceed.

If we are to proceed, we need a clear signal such that our investment bankers on Wall Street can, in fact, put this financial package together such that we can start production as soon as possible and move forward in getting these vehicles going. We can move as quickly as anyone to build vehicles and to provide this launch service to the Nation.

Mr. **Nelson**. Well, does that mean that you need guaranteed payloads?

Mr. **Grimes**. No; we don't need guaranteed payloads.

Mr. **Nelson**. Do you need funding or some other kind of subsidy?

Mr. **Grimes**. No; we don't need any subsidy. All we need is a clear statement that we will be permitted to go, that we have a definitive agreement, that the definitive agreement is signed by NASA.

For instance, we are sitting here toward the end of March. We had an agreement with NASA that had—we asked for an extension in the middle of February, and we are yet to have a clear-cut extension from NASA on that agreement.

As Ike Gillam said, they wrote us a letter saying they are going to send it, but telling us they are going to send it is not the same as sending it to us, and that gives us cause, when we deal with the investment banking community, of just where are you with NASA.

Mr. **Nelson**. Well, you heard about me questioning him.

Mr. **Grimes**. I did, sir.

Mr. **Nelson**. Yes, sir. You know, something else that is very interesting came out of that hearing yesterday. We were talking about the viability of financing an orbiter, and one of the proposals that was in the testimony to the committee was, well, they would fund it on a purchase-leaseback to the Government arrangement, but that the incentives to really do that would be in the marketing of commercial payloads on the shuttle.

Now, how does that fit, because that commercial entity then becomes a competitor to your enterprise. How do you see all of that fitting?

Mr. **Grimes**. Well, I am not aware of the exact parameters of that proposal.

Mr. **Nelson**. Well, they aren't, either. [Laughter.]

They haven't put it together. It is just a lot of conversation. But assuming that there were such coming, how does that affect you?

Mr. **Grimes**. Well, given what we learned during our studies of shuttle pricing, of the true cost of operation of the shuttle last year during the shuttle pricing controversy, I feel that if they would like to market that service, we would love to compete against them in a nonsubsidized manner. I think we could probably undercut the price by 25 or 30 percent in terms of this launch vehicle.

This launch vehicle is a state-of-the-art, Mr. Chairman, that is configured as close to the maximum weight capability to orbit as you can configure it, and it terms of cost competitiveness, it is a great competitive vehicle.

Mr. **Nelson**. You are about 2,500 pounds to geosync, aren't you?

Mr. **Grimes**. Twenty-eight hundred and fifty, yes.

Mr. **Nelson**. Twenty-eight hundred and fifty pounds.

Mr. **Grimes**. Geosync transfer, and that is the typical bread-and-butter satellite such as the RCA's, the Western Union Westars, RCA Satcoms, the Hughes Galaxy Birds, all of which have been flown on Delta up through the termination of the program.

Mr. **Nelson**. We have another vote, and I apologize, but I am not calling the votes over there.

Mr. **Grimes**. That is quite all right.

Mr. Nelson. So, if you will excuse me, I will run over, will vote and come right back. By the time I get downstairs, get on the little electric train, get over there and get up the elevator, vote and come back, it will probably be 10 minutes, so I will hurry as fast as I can.

[Recess.]

Mr. Nelson. The subcommittee will resume.

Mr. Grimes, one of the things that I had asked earlier to a previous witness today was that we had heard that the DOD was going to need some of this Delta hardware for SDI. Do you know anything about that?

Mr. Grimes. Yes, we were made aware of that in June 1985 when our then-current extension was up. What happened there, to the best of our understanding, the Department of Defense came in and asked for certain elements of the hardware in the Delta inventory to generate certain spacecraft units for DOD. They are called DOD Flight Experiments I and II.

That gave us great concern, and in order to resolve that issue, in that the commitment had already been made by NASA to DOD to support those activities, that gave us great concern, but since we were not yet up and running because of the shuttle pricing issue, we took a nonimpediment road, if you will, for the activity of the DOD and agreed to let that hardware be set aside, the elements to build the DOD Flight Experiments I and II, and that, although we didn't know what was in that hardware set, we had an agreement with NASA that DOT would monitor a meeting between ourselves and DOD, and we would come to an agreement that NASA would be the holder of the hardware, I mean McDonnell Douglas would be the holder of the hardware, and that we would get an agreement with MACDAC on how soon they could build our first vehicle. That vehicle was Delta 182.

In building that vehicle, we assessed the impact of our program on how long that vehicle was pushed out because of the amount of residual hardware that was withdrawn. I know this is a long, complicated answer. But we found that that pushout on schedule was not terribly detrimental to us, and therefore, we thought that was adequate.

So the next agreement we went under, amendment No. 5, in December 1985, had the language that permitted DOD to have a portion of the hardware and we would have the rest.

Mr. Nelson. Now, specifically, you mentioned vehicle 182. So you are saying that, as far as you know, the Government doesn't have a need for vehicle 182?

Mr. Grimes. For 182 through 192. We had under a preliminary agreement the rights to the residual hardware for vehicles 182 through 192. We also had the rights to purchase at 100 percent the 180 and 181 vehicles if in fact there was no NASA or other Government need for those vehicles.

The DOD has now acquired the 180 and 181 vehicles. Beyond that, there are no vehicle requirements; there are only piece part requirements from the residual inventory to build these certain DOD flight experiments.

Mr. Nelson. And does that answer apply to the spares as well?

Mr. Grimes. The spares issue has never been fully understood, and then MACDAC is the holder of the total set of hardware, and of course we would always enter into a reasonable agreement with NASA to provide spares to their ongoing mission complement as they phase out and we phase up.

So the spares issue never was a real issue as far as we were concerned in terms of those hardware availabilities.

Mr. **Nelson**. Back a year ago when we were going through this fracas on the pricing policy, your company took the position that the price ought to be $150 million for an equivalent cargo bay in that timeframe, 1989, 1990, and 1991. How do you feel about that?

Mr. **Grimes**. I think we took the position that a reasonable price on a full-cost reimbursement policy would be in that order, $150 million price category. To tell you truthfully, sir. Mr. Chairman, we had to go through a very strong scrubbing exercise to get our price structure realigned after that pricing policy was annnounced.

But our price, that price, obviously, that we supported, was a price that we could live with, operate with, and have a commerical profit with.

Mr. **Nelson**. Which? the price that was adopted?

Mr. **Grimes**. No; the price that was supported in committee here.

Mr. **Nelson**. The $150 million?

Mr. **Grimes**. That is right. Our true price, in terms of business plan, was somewhat less. There was a contingency factor in that supported price. With the scribbed vehicle, we have now achieved a vehicle that, with a float on the shuttle price, because of it being an auction, a limited marketplace with an auction, we determined that that shuttle price would probably float 10 percent, an given the economies that we were able to get into the restructuring of our program, we feel that we can be competitive.

Mr. **Nelson**. Well, TCI testified to this committee that you could not be competitive unless the shuttle price we at least $150 million per cargo bay for that time period starting in 1989.

Now the shuttle price is no more than $74 million for that equivalent period. How can you suddenly be competitive when the price is less than half what your company testifed last summer?

Mr. **Grimes**. Well, No. 1 it is not less than half, sir. You have to include the shuttle, the PAM–IV shuttle, I would be glad to give you a complete rundown on the analysis of the numbers that shows where we were with the contingency, with the reductions in the use of the PAM as a third stage—if I could use this [model] to demonstrate—with the use of the PAM as a third stage, going to smaller 37-inch, solid, going to a smaller second stage, of incorporating Caster 4–A's, which have been developed by NASA since 1982 and have not yet been incorporated in the vehicle, and by using a 12-to-1 nozzle engine, one can in fact compete at about a $100 million to $110 million equivalent shuttle price.

Mr. **Nelson**. Well, I was with you until that last statement. How does $100 to $110 million equate to $74 million?

Mr. **Grimes**. Because we are looking at a float and an insurance differential, and I failed to mention the insurance differential.

Mr. **Nelson**. all right. Well, explain that to me.

Mr. **Grimes**. The insurance differential? With respect to a Delta stack, we have a $100 million stack value.

We feel that we can operate at about three points below the average market price on insurance because of single-mission service, no accumulation, all those parameters that cause the——

Mr. NELSON. Oh, you mean compared to the insurance that one would have to take out on the shuttle?

Mr. GRIMES. The shuttle or the Ariane, that is right.

Mr. NELSON. Or the Ariane?

Mr. GRIMES. That is right, because both of those are multiple-payload capabilities.

Mr. NELSON. And you have nailed this down with your insurers?

Mr. GRIMES. We are in constant—well, not constant communication, but we communicate at least every other week.

Mr. NELSON. The fact of a couple of Ariane explosions, that is not going to affect the insurance on yours?

Mr. GRIMES. What we end up doing is, we end up moving up as a group, but we always end up at the bottom side of the spread, as a group of insured opportunities.

Mr. NELSON. All right. So you are saying that you can be competitive even if shuttle, whether it be government or private, is flying at the equivalent of $74 million, 1982 dollars, per cargo bay in 1989. Is that correct?

Mr. GRIMES. We can be competitive. I would say that the more appropriate things for us to look at is whether we want to continue that unbalanced playing field and cause us to operate at those levels of profitability. The level of profitability was reduced in making that assessment, and again, we would be glad to share with you those numbers in detail, because one has to go down through the full rackup of numbers in order to see what the profitability is.

But I would say that a modest increase in the shuttle price would give us a profitability that would make us very, very successful.

Mr. NELSON. And you are saying that the difference between your testimony of your company last year and now is the difference between $150 million and $74 million.

Competitiveness is, No. 1—I want him to hear this—No. 1 is, you have said it is your insurance costs are less, and, No. 2, the float, and when you are saying the float, you are talking about the value of the dollar?

Mr. GRIMES. No; I am talking about the float on the cost of a payload being flown by orbiter because it is an auction price, because we feel that the need for service is such that the auction price will float, and we took a 10-percent gain on that float.

Mr. NELSON. Explain that some more. You are talking about it will float up?

Mr. GRIMES. Well, $74 million would go to $81 million in terms of an auction system.

Mr. NELSON. I see. In 1982 dollars?

Mr. GRIMES. In 1982 dollars. I believe that is what the pricing is in, yes.

Mr. NELSON. Dr. Dawson, is that what you heard would happen as a result of an auction?

Mr. DAWSON. NASA hasn't yet discussed any numbers regarding what they think the effect of the auction could be as a result of the *Challenger* accident.

Mr. GRIMES. We had to make those assumptions, Mr. Chairman, because we had to assume how an auction would operate in an environment where the marketplace for that auction was restricted to a small percentage of the marketplace, a reasonably small percentage of the marketplace.

That was one assumption we made. We made a scrub of the vehicle, and we did the insurance advantage.

Mr. NELSON. All right. I am trying to understand something about your competitiveness, because we have gotten all kinds of different, conflicting information here.

Could you produce and fly six Deltas a year?

Mr. GRIMES. Can we produce and fly six Deltas a year and be competitive against the $74 million?

The question is the $74 million price? We would probably make about a zero profit. Our profit margin goes down if in fact we operate at the $74 million. If we put those floats and the insurance differential in, and the modification of the vehicle against the—to reduce the cost of the vehicle, we could make a modest profit.

Mr. NELSON. I want you to understand, all of my poking and probing is that you are here on the question of assured access to space.

Mr. GRIMES. Sure.

Mr. NELSON. And, right off, you can nail down the fact that this committee supports it being an American vehicle——

Mr. GRIMES. I appreciate it.

Mr. NELSON [continuing]. Being a shuttle or an ELV that is going to carry these payloads. And there are a certain number of payloads out there that are commercial payloads. Now, we want it to be an American vehicle that is carrying it.

I am trying to understand something about your proposals. Assume you had six Deltas a year that you were flying. What, approximately, is the cost of those vehicles? In other words, what is your price? What is your price?

Mr. GRIMES. The price is about $33 million. Thirty-three-and-a-half million dollars is what our business plan price is.

Mr. REESE. In 1985 dollars.

Mr. GRIMES. In 1985 dollars.

Mr. NELSON. Thirty-three-and-a-half million?

Mr. GRIMES. In 1985 dollars. And that is about $28 or $29——

Mr. NELSON. Did it used to be $40 million?

Mr. GRIMES. Thirty-seven-and-a-half.

Mr. NELSON. Thirty-seven-and-a-half, and you revised it down to $33.5 million?

Mr. GRIMES. That is right.

Mr. NELSON. How did you do that?

Mr. GRIMES. The third stage and the second stage and the engine.

Mr. NELSON. Now, this is just tightening up on the parts of the vehicle, or is it better technology or what?

Mr. GRIMES. It is improved performance because we target against a fixed payload, which is the 2,800 pounds we have talked about before.

Mr. NELSON. OK, $33.5 million. All right, now, if I recall, we asked the Ariane folk what they would sell—this was sometime last year—what they would sell a payload for, and they would put two up there, and if I recall, they said about $50 million, or $25 million apiece, equivalent payloads. Is that correct?

Mr. GRIMES. Essentially equivalent, yes. When was that question answered?

Mr. NELSON. Last year.

Mr. GRIMES. Last year.

Mr. NELSON. OK. so——

Mr. GRIMES. And that was in 1982 dollars, or was that in 1985 dollars?

Mr. NELSON. I don't know in what dollars it was.

Mr. GRIMES. Because they generally quote in 1982 dollars.

Mr. NELSON. What would be their price then, this year?

Mr. GRIMES. What was that number $25 million?

Mr. NELSON. It was $25 million last year.

Mr. GRIMES. Adding 16 percent, the answer is about $29 million in 1985 dollars.

Mr. NELSON. All right. Now, how can you sell it at $33.5 million if they are selling it at $29 million?

Mr. GRIMES. We are just about on top of each other because of the insurance differential.

Mr. NELSON. Oh, you had not factored that in yet?

Mr. GRIMES. No.

Mr. NELSON. I see. Well, that is encouraging.

Mr. GRIMES. Yes, we feel very encouraged that we can compete head-on and with their pricing structure, with the other service elements that we bring to the marketplace. Single-mission service is very important, Mr. Chairman, and we feel that the American rocket, as we like to call it, is a very strong competitor for the free world marketplace.

Mr. NELSON. This doesn't have anything to do with anything. Why is it green?

Mr. GRIMES. Well, that is a coating you put on the aluminum to keep it from corroding in the atmosphere down at the Cape, and we just don't like to paint it white because it costs too much payload because of the white paint, and it is like painting an aircraft. You generally don't like to paint aircraft?

Mr. NELSON. Sure.

When did you find out about this improved performance capability that you said that you put on the top stage and on the second stage?

Mr. GRIMES. That came about during the last spring and summer of 1985. We have been studying an engine modification because the Delta history—we fly what is called an RS-27 engine built by Rocketdyne. That engine, we had 100 of them in the Delta program starting in 1974. They came off the Saturn program. They have been out of production for this long period of time now, and we are either going to have to start that production line up or we are going to have to change out the engine to a contemporary that is in production.

In looking at a contemporary engine in production, we found a very substantial improvement in performance, and that was done—and also in price. So we jacked the performance up and got the price down.

Mr. NELSON. Has MACDAC been working with you on that?

Mr. GRIMES. MACDAC is aware of it, yes.

Mr. NELSON. Well, it is certainly in their interest to work with you on that, I would think. They haven't?

Mr. GRIMES. The nature of the—MACDAC is aware. They have dealt with the subcontractor that we have been dealing with on the engine change-out.

Mr. NELSON. Well, that is very diplomatically put, Mr. Grimes.

Mr. GRIMES. Well, it has to be sir——

Mr. NELSON. I understand, I understand.

Mr. GRIMES [continuing]. In that we have not yet turned MACDAC on for production activity, and therefore, anything they do is on the—we have a small contract with McDonnell Douglas. We intend to give them funding in the very near term for preproduction activity, and as soon as we can finalize our financing in the marketplace in New York, we will be starting up production.

We are just in receipt, within the last 2 weeks, of a not-to-exceed contract for startup of production of 17 vehicles.

Mr. NELSON. Let me go back to yesterday's testimony again. At one point I was surprised in the testimony. This was the question of private financing of an orbiter. They said the incentive would be the marketing arrangement. Then they said the marketing arrangement was not only to market commercial payloads in the shuttle but would be to market payloads on ELV's as well.

Now, that completely flies in the face of what you would be trying to do.

Mr. GRIMES. Well, it certainly flies in the face of the agreement we have with NASA and what occurred back in 1983 and 1984 in selection of Atlas Centaur, General Dynamics, and ourselves for Delta in commercializing the two current NASA ELV's. So, I don't think that proposal would have merit in the face of those two agreements that are currently being negotiated with the two companies. I don't know what else was in the mind of Mr. Rockwell when he made that proposal with respect to other vehicles.

Mr. NELSON. Well, we will be interested in finding out about that some more. You know, the way we have been conducting these hearings on assured access, we have been having everybody come. We are trying to plow new ground and stimulate ideas.

I don't know what form it is going to take, but I know that we need shuttles and ELV's, and we want—anything that is going to fly, we want it to be American if it is going to have American payloads. And yet we don't want to completely get in and regulate the whole thing. So let's see what we can do.

Now, let go back to DOD and its needs for Delta. What is it going to mean for you if they suddenly start taking a bunch of these vehicles? What were their names?

Mr. GRIMES. Numbers 182 through 190.

Mr. NELSON. Numbers 182 through 184 in particular is what we have heard? I know you said 192.

Mr. GRIMES. Well, we have hardware in the system from 182 through 192, partially completed vehicles down to small sets of piece parts to build vehicles, and that is integral to our startup transient of being able to provide 2 missions in 1987, 4 in 1988, 7 in 1989, and 10 thereafter.

So to withhold this hardware from us would essentially defer our ability to proceed. However, a vehicle is a vehicle. If there is a mission for DOD that has to be flown, there is no reason why it cannot be a commercial Delta. The Delta is exactly the same.

There is no program office required by the Government. We in fact can do the program office function. DOD can operate against our company as the program office, the participating agency, and it would make immense sense to make use of TCI for those flights.

In fact, when 180 and 181 came up one of the bits of—well, and embarrassment was that it was not even considered to come to TCI and suggest that possibly the 180 and 181 could be flown as commercial Deltas in the commercialization process for the Nation's expendables. But I would think that, beyond 181, we should make an attempt, I would hope we would make an attempt, to make the rest of those missions commercial Deltas.

Mr. NELSON. If DOD needed some extra Deltas, would that mean that they would crank up the production line at MACDAC, and that would mean that you could get the commercial vehicles at a cheaper price, since they were going to crank up the production line anyway?

Mr. GRIMES. I think we would pay an equivalent price. DOD is not used to giving any money away. In fact, in the discussion with the program manager at McDonnell Douglas last week, week before last, he indicated that there was a $400,000 expenditure on the startup of vehicle 182 that DOD wanted returned when we built that vehicle.

It is not clear that they have an interest in building additional vehicles at the moment, and it is not clear that they wouldn't just as soon have commercial capability to build those vehicles, and they could buy them on a mission-by-mission basis.

Mr. NELSON. You are basically looking at 10 vehicles left?

Mr. GRIMES. We are looking at 11 total, that is right.

Mr. NELSON. Eleven.

Mr. GRIMES. And then, of course, we would order—we would accelerate the delivery of additional parts in terms of bringing the line up as quickly as possible.

Mr. NELSON. And are those—if you got an agreement and you had customers, are those ready in the production line so that they could go on and be built?

Mr. GRIMES. Well, the production line is stopped right now, but we have a capitalization of about $10 million required in the first several months to bring all the production facility back up and up to speed.

We have the not-to-exceed proposal which we are in receipt of. McDonnell Douglas has that built into the base of the proposal, and they are prepared to proceed. What they need is the authorization to proceed. They need the authorization from NASA for use of the hardware, and we need the authorization to go put our financing in place so we can contract with McDonnell Douglas as part of that closing of financing and be off and running.

Mr. NELSON. All right. Now, you are under this supposed agreement that you may enact with NASA. You are buying the Deltas from NASA at 87.5 percent of what NASA paid for the Deltas?

Mr. GRIMES. We are buying the residual hardware at 87.5 percent. That was the negotiated value; that is right.

Mr. NELSON. I thought you said you didn't have an agreement.

Mr. GRIMES. We have a preliminary agreement that has the negotiated value in the agreement.

Mr. NELSON. Preliminary.

Mr. GRIMES. The preliminary agreement is an agreement. What we don't have is the final, definitive agreement which they are now——

Mr. NELSON. I see, preliminaries and final.

Mr. GRIMES. That is right. It is an odd circumstance, but we were not prepared to go to a definitive agreement at the time we got started.

Mr. NELSON. Well, why would NASA want to sell you something at 12.5 percent less than what they paid for it?

Mr. GRIMES. That was the negotiation, and maybe we were good negotiators. At that time, we were somewhat miffed that we could not get it at 75 percent at the time, because there was no need for that hardware.

Mr. NELSON. When was that negotiated agreement?

Mr. GRIMES. That negotiation took place right before Christmas in 1983.

Mr. NELSON. In 1983. But now Gramm-Rudman is here. So why would NASA want to give you something for 12.5 percent less?

Mr. GRIMES. Well, the agreement has already been struck, and unless we modify the agreement, I would think that they would want to honor that negotiated position of 1983.

Mr. NELSON. Unless they don't have the dollars to do that.

Mr. GRIMES. Well, it is dollars returned to the Treasury, sir. Now, I agree, dollars are dollars, but it is dollars returned to the Treasury.

Mr. NELSON. Well, let me make sure that I understand.

Mr. GRIMES. Well, the cost is sunk, I mean, those dollars have already been spent on that hardware, and the issue was, what was the scrap value of the hardware when we negotiated it.

Mr. NELSON. I see. The fact that NASA has already—so, in 1983, NASA had a bunch of Deltas on its hands, is in essence what it was.

Mr. GRIMES. That is right.

Mr. NELSON. And you were going to relieve those Deltas from NASA by paying them 87.5 percent of that purchase price.

Mr. GRIMES. That is right.

Mr. NELSON. But NASA hadn't made that purchase yet, had they?

Mr. GRIMES. No, they had made that purchase. Those dollars were already sunk.

Mr. NELSON. They were already spent?

Mr. GRIMES. Yes, they were already spent.

Mr. NELSON. This is not new money that is going to be spent on these Deltas?

Mr. GRIMES. No, it is old money that has been spent. It is sunk, and the payments will just revert to the Treasury, although it is real money.

Mr. Nelson. In other words, at the time the hardware was surplus.

Mr. Grimes. That is right, sunk-cost hardware surplus.

Mr. Nelson. But if in fact DOD steps in and the Government has a mission, then it is not surplus?

Mr. Grimes. Well, that is correct.

Mr. Nelson. And that is the $64 question. You just don't know that at this point. Is that correct?

Mr. Grimes. Well, I don't think that—you know, the 12.5-percent differential, we are talking about a total of $30 million of hardware, so 12.5 percent, we are talking about a $4 or $5 million question.

Mr. Nelson. I am not talking dollars now, I am talking about the question of whether or not it is surplus.

Mr. Grimes. No. Under our agreement, it was declared surplus, and it is not—I would suggest that the agreement is still binding. When we went to amendment 5, it was to accommodate an unfortunate set of circumstances. We consider it still to be surplus, and therefore, that agreement is still to be in place.

The definitive agreement that we are negotiating now, we have been negotiating since December, carries that same percentage discount in the body of the document, and there has been no suggestion by NASA that they are not going to honor that 87.5 percent price.

Mr. Nelson. Answer this question for me. This committee is going to ask me, as its chairman, for a recommendation on this stuff. One of the questions they are going to ask me is, why should, as a matter of public policy, NASA sell something to you for 87.5 cents on the dollar and then turn around and pay you a premium to fly a Government mission on that same vehicle that it has just discounted to you?

Mr. Grimes. We have not suggested that that be the case. In fact, if we would like to negotiate that, I am sure we would return the discount on any vehicles we fly for NASA.

The other point that Earl Reese, our Director of Technical Operations, who has been following this hardware issue very diligently, makes is that there is a risk in the hardware. What we are doing is, we are buying hardware that has been surplus, has been sitting, and we don't know whether there is any breakage. The breakage activity is not covered in our agreement, and it is not clear that we won't have a 10-percent breakage and therefore be about net on the real hardware cost.

But I stand by my comment. If we get to that negotiation, we would certainly honor a—if in fact we got a 12.5-percent discount for particular hardware on the vehicle and that vehicle was sold to the Government, we would certainly return that discount.

Mr. Nelson. Last summer, when we were—all right, and I am glad you clarified that, because the members of the committee are going to be asking that.

Mr. Grimes. Certainly.

Mr. Nelson. Now, last summer, when we had these hearings on assured access, I remember that some of the witnesses from the private sector, when I asked them the question, "Why haven't you signed up with TCI?" responded that since you were a small company, they felt that they did not have the assurance that you were going to fly, or they thought that there was a higher risk that you might not survive and be able to deliver their payload to space. What is your response to that?

Mr. GRIMES. Well, that is exactly the point I tried to cover in my summary testimony. In the summer of 1984, when we came up against that point on the SBS competition, SBS wanted to be guaranteed through 1987; NASA was only going to operate at that point in time through 1986.

We brought First Boston Corp. into the act to generate the set of guarantees, the financing for guarantees, to provide that assurance. that is the assurance that we are now putting in place for startup production.

We will have sufficient source of capital to assure a customer that if he signs up with us—he is the first customer—if he signs up with us, that we will have enough capital in the system to operate through the point where he gets launched so that we can have that assurance. It is basically a self-insurance program for business that we are putting in place. We recognized that back in May-June 1984, and we are now putting that in place.

Mr. NELSON. Does that mean you have sufficient capital to withstand the financial impact of a major technical problem? I am thinking of the redesign and requalification of the PAM nozzles?

Mr. GRIMES. Well, that is a very interesting point. In 1981, I was a party to the first activity on redesign of the PAM nozzles. I wasn't a party to the one in 1984 when we lost the two off shuttle. But the answer is, that is business insurance that one acquires for each event that you undertake, and we intend to have business insurance of those amounts such that we can survive such a redesign activity.

I may point out that, in 1977, when the last failure of Delta occurred that was a Delta failure, that redesign activity for one of these Caster 4's cost the Government about $10.5 million, I believe was the number, and it was performed over a period of 8 months. However, we were able to move forward and fly other vehicles because we had smaller casters at that time.

This vehicle is well fashioned to not give us problems. It has been very well proven, and we feel that we can support a business insurance base that will give us the capacity to correct any technical deficiencies that we find in any given flight.

Mr. NELSON. Any technical deficiencies?

Mr. GRIMES. That is right.

Mr. NELSON. Including the recurrence of something that happened like 2 years ago when you had to redesign and requalify?

Mr. GRIMES. That was the PAM? Our principal mission does not require the PAM. On the PAM, if I may, we suggest that PAM requalification in 1981 when we had the failure in December 1980 in the test cell. That did not come about. It came about after the two failures off of shuttle.

That requalification has made the PAM a very stable, very solid performer, and we have no problems with flying PAM off Delta in that configuration.

Mr. NELSON. All right, let's talk about the future. What improvments will you make in this vehicle to keep pace with the changes of the payload community?

Mr. GRIMES. I have already talked about a few of those changes which brought the price down for a 2,800-pound capability. With those changes at 2,800 pounds, this vehicle, fully augmented, will take us to 3,500 pounds. So the range went from 2,800 up to 3,500 pounds.

Beyond that, we have the capability and the design, the paper designs, to modify these casters by extending them to raise the capability of this vehicle above 4,000 pounds. Beyond that, if the marketplace requires and it looks like it is a prudent thing to do, we can actually do a LOX-hydrogen second stage for this vehicle. I am not suggesting that we will commit to that, but it can be done, and it is 1960's technology. It is actually a 6S4–A booster that MACDAC did back in the early sixties in the Apollo Program.

Then we would modify the ferring, be able to carry a 10-foot payload, and we would have essentially a 5,000-pound capability bird similar to what the Atlas Centaur is today. So this is not a defunct bird. This bird has got plenty of growth capability and room to increase its capacity in the marketplace.

Mr. NELSON. Why wouldn't it be in the interest of MACDAC to cooperate with you on these modifications?

Mr. GRIMES. I am not suggesting that they will not. It is a matter of startup transient, and we fully expect them to be very cooperative.

Mr. NELSON. But then why haven't they?

Mr. GRIMES. We haven't asked them to be, at the moment. What we are doing is, we are putting this in place. We have sufficient capacity outside of McDonnell Douglas. McDonnell Douglas is aware of the issues. We have not just employed them yet to study the problems in detail. When the problems become fully developed such that they can study them in detail, then we will go under contract with them for these modifications.

Mr. NELSON. All right. Now, where will you get the funds to make these improvements, and how much will it cost?

Mr. GRIMES. Well, the funds will be brought from the capital markets. We don't have the specifics on the various stages, but let me give you an example.

The modification to the engine runs about $27 million, I believe, $27.5 million to be three-place accurate. That capital is going to be done in a sinking funds to be prorated against the various units that fly this particular engine. So the engine costs a certain amount; we will put a royalty fund on it; we will capitalize it from the existing cash-flow of the company, and that is the strategy for that particular modification. We have an R&D activity, an R&D line on the plan, the business plan, which will take care of putting the Caster 4-A's in place. The Caster 4-A's cost us about $4 million to fully certify and incorporate into the vehicle.

The other modifications I mentioned are not modifications to the vehicle. We already have those capabilities on line.

Mr. NELSON. What launch facilities would you plan to use?

Mr. GRIMES. We will be launching from Cape Canaveral and Vandenberg Air Force Base. The launch complex 17–A and 17–B would be used for the more common variety of satellite, the communications satellite and the weather satellites. The Earth observation satellites would be launched from Vandenberg Air Force Base, and that is Complex SLC 2-West, Space Launch Complex 2-West.

Mr. NELSON. And how much would it cost to activate those facilities?

Mr. GRIMES. The facilities at the Cape are already activated. They are ongoing, and we will just maintain them.

The transition would be to, when NASA has completed their work, we would just take over the launch service team that McDonnell Douglas has in place, hire a lot of the NASA employees that are in place on the NASA team into TCI, and just do a transition, a very smooth transition. The Vandenberg facility has been shut down now since the last launch, which I believe was Landsat D-prime, and it has been mothballed, but it is under the care of the Air Force, who have a contract with McDonnell Douglas for the care and feeding of the facility until we want to bring it back up, and we would bring that back up—we don't have a hard number on the cost of reactivating that system, but I would say it is a very modest cost.

Mr. NELSON. And how many launches per year would it take you to break even,

Mr. GRIMES. We have a business plan with the numbers we have stated that breaks even at about four missions a year.

Mr. NELSON. Four?

Mr. GRIMES. Four missions a year.

Mr. NELSON. Now, has the shuttle accident changed your view on the marketability or the market for launch capacity?

Mr. GRIMES. It has certainly accelerated our view of when the service could be assured to be used. We were planning a much more stretched-out startup transient for the company, and now we have brought things in because of the need and the shortfall in market capacity that is now a fact of life in the community.

Mr. NELSON. Well, most of us here think that it is essential for the interests-of the country that we have to have a replacement for *Challenger.* Rocketdyne would build those SSME's for a replacement orbiter. Now, can it build engines for you and for the SSME at the same time?

Mr. GRIMES. Oh, by all means, yes. Rocketdyne has an ongoing fabrication activity for orbiter engine parts, and I would say that is just falling neatly in place for their work flow.

The engine activity we are a little more antsy about, if you will, is the Atlas activity and the fact that there are three engines on an Atlas instead of one like Delta, and therefore it takes a lot of capacity out of the Rocketdyne facility, but we are working on that problem.

Mr. NELSON. You don't think it would slow the work on the SSME's?

Mr. GRIMES. I don't think it would slow the work on the SSME's. I think that would take priority, and we would just have to make sure that our work was not slowed up, that they would staff properly to keep our work from being slowed up.

Mr. **Nelson**. A while back, you said that it would make sense for the DOD to come to you to get those Deltas. Now, why is that?

Mr. **Grimes**. Well, we have proposed to the Department of Defense, the GPS office—we were asked to submit a proposal several weeks ago to fly GPS satellites, and we think it has been a policy of the Department of Defense to support commercialization of space transportation, and we just feel it is a natural extension of that policy.

Mr. **Nelson**. Why wouldn't they buy directly from MACDAC?

Mr. **Grimes**. Well, they would staff an activity to monitor the activity—I mean, you just don't go out and buy a launch vehicle. You have to have a program office, you have to have all those things that would cause them to have to staff a Delta project office just the same as NASA staffed a Delta project office of about 50 people during the course of its 25-year history.

What TCI represents is that project office in the private sector, and it just makes immense sense not to have to duplicate that activity.

Mr. **Nelson**. You don't think the manufacturer could give a better price than you could on a Delta launch vehicle?

Mr. **Grimes**. The manufacturer could possibly give a somewhat better price. I think probably that we have pens as sharp as anyone, and if we cannot sharpen our pens by 10 percent, I would be surprised. If you look at that differential in price, we are talking about a very modest number.

Also, if we in fact have the full line, which we would think would be wise, we should be able to do a discount base because of volume discount.

Mr. **Nelson**. Talking about that project office, you don't think that the Air Force would have to establish a project office to monitor TCI under that scenario?

Mr. **Grimes**. Well, I think they would, but what they would use is the program office. More than having a vehicle office, they would use the program office of the spacecraft. It is just like any spacecraft user. They don't have a vehicle office to monitor the vehicle; they have a spacecraft office and a vehicle man that buys the vehicle and does the coordination activity. But they don't have to build the vehicle. Delta is built by the program office that is in control of the contracts.

Mr. **Nelson**. Well, you have provided us with some very interesting testimony, and we appreciate this. I think we need to take a hard look at everything on the able, and that is why we are having these hearings.

When I said a while ago—I got to thinking after I said it that maybe people might have misinterpreted what I said. In talking about looking to the future, the decisions still haven't been made. But we do know that the likelihood is, for national security purposes—that is what I meant—that we need a mix in the stable between shuttle and ELV's.

Mr. **Grimes**. Of course.

Mr. **Nelson**. And then how this then spills over into the question of the commercial market is what we are interested in looking at, because we definitely want those—this committee wants those satellites going up in American launchers, particularly American satellites.

So that is what we are trying to explore, and there are whole new bunches of factors that are now factored in this thing, not the least of which is when would the administration be forthcoming with a recommendation on a replacement, how many ELV's they will request for the DOD, what types of ELV's and then can we pass it in the Congress, given the constraints of Gramm-Rudman?

So we have got a whole new plateful. Let me restate that. We have a whole new menu, and now we have to see what we are going to be able to order.

Dr. Byerly, do you have anything?

Mr. **Byerly**. No.

Mr. **Nelson**. Does anybody else on the staff have any questions? [No response.]

Well, you have been most patient today, and I do appreciate that.

Mr. **Grimes**. We appreciate the opportunity, Mr. Chairman, and just let me reiterate that we are ready to go. We would like to go. We have the restraint of not having the hardware rights enumerated or stated to McDonnell Douglas so they can pick up and run with this.

We had hoped that this issue would be resolved such that we can get on with building vehicles in the very near term, and we would like those vehicles to be commercial vehicles, and I hope we can ask the support of this committee in making that happen.

Mr. **Nelson**. Thank you for your testimony. Have a good today. The meeting is adjourned.

[Whereupon, at 4:08 p.m., the subcommittee was adjourned.]

[Whereupon, at 4:50 p.m., the subcommittee adjourned subject to the call of the Chair.]

PAYLOAD PRIORITIES

THURSDAY, JULY 17, 1986

House of Representatives,
Committee on Science and Technology,
Subcommittee on Space Science and Applications,
Washington, D.C.

The subcommittee met, pursuant to notice, at 2:05 p.m., in room 2325, Rayburn House Office Building, Hon. Bill Nelson (chairman of the subcommittee) presiding.

Mr. Nelson. Good afternoon. I understand we are out of seats for members of the press and legislative assistants, so, if there are no seats, I invite you to come right up here, as Mr. Reidy has already availed himself. You all help yourself right along here. These are nice, comfortable seats. Anyone standing in the back, if you cannot find a seat, you are welcome to sit up here.

Well, this subcommittee is going to have a continuing series of hearings on the question of assured access to space, which, as you know, we started this last summer; we have learned a lot; we have a lot more to learn, particularly in light of changed circumstances.

Now, with the release of the Rogers' Commission report, we must now continue the consideration of how the Government is going to manage its launch resources and then, given what the resources are, how it balances the needs of commercial interests, science, national security, and other space activities.

So, this subcommittee has specifically requested that NASA present to us a manifest which we can discuss. I hope our witnesses are going to be prepared to respond to that. I know that we have to hang out there in being flexible because there are still a lot of uncertainties.

As a matter of fact, frankly, when we set up this hearing, we thought that as of last Monday that we were going to have a decision from the President on his request to the Congress on the question of a replacement orbiter and other items, but that was not to be, and thus we continue to wait. And, therefore, we will have to consider the flexibility and the constraints that are placed upon you guys who are representing the administration, talking to us today.

Now, what we want to emphasize today is not specific launch dates, but the process. We want to look at how launch priorities are assigned and what this means for the user communities.

We recently gained a little bit of insight into this whole process. We learned that NASA was prepared to offer one of our three remaining Delta vehicles to a foreign Government to launch one of its communications satellites. Without commenting on whether, after you consider all the pluses and minuses, this is a good or bad proposal, it has become clear that the process was certainly inappropriate.

This committee was informed on the eve before the offer was made, and this committee has been given no information on how NASA believes this offer and related actions will affect our national need for a robust transportation system.

Now, let me emphasize that, at this time of transition to a mixed fleet, we must not let ad hoc decisions on single launches preempt our policy positions, and I can guarantee you that this committee is not going to let that happen, and thus we have had a few prayer sessions since with NASA.

The continuing lack of cooperation between the administration and Congress in space matters could be mighty disturbing, and I hope that we are going to set about the process of starting to remedy it.

It is apparent that our launch resources are a precious, national commodity and that we have to see that they are managed properly. Congress must set the policy, not the micromanaged, detailed manifest of the payloads.

What must be avoided is de facto policymaking through incoherent assignment of launch priorities to particular payloads.

So, today we are hoping to hear from officials in NASA and the Defense Department who are responsible for developing launch manifests.

It is always a pleasure to continue to extend our welcome to Admiral Truly and Mr. Gillam, and we are delighted that General Randolph is here representing the Air Force.

We have extended an invitation to the Secretary of the Air Force to be with us today, but he had to be out of town, and we will look forward to his future testimony to this committee.

We will have submitted a statement for the record from Bob Walker; and so let's proceed, and we will start with Admiral Truly, and then we will go to you, General, and then Mr. Gillam.

STATEMENT OF ADM. RICHARD H. TRULY, ASSOCIATE ADMINISTRATOR FOR OFFICE OF SPACE FLIGHT, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Admiral **Truly**. Thank you, Mr. Chairman, and let me say that I am extremely pleased to be here today.

As you know, Dr. Fletcher recently submitted to the President our response to the commission report on the *Challenger* accident. We have been working on the difficulties of the manifesting process for some time.

I believe that these series of hearings are on a most important and most crucial subject, and what I would like to do today is discuss just what you said, which is the process, some of the complexities, and so forth. With your permission, I would like to submit my statement for the record and make some oral summations, please, sir.

Mr. **Nelson**. Absolutely. Please proceed.

Admiral **Truly**. In order to deal with the subject of shuttle manifesting, I think you have called, in the next few days, the proper sequence of witnesses which represent the major categories of customers to the space transportation system: those of national security; NASA missions, which are primarily dominated by NASA science; space technology; and, in the midnineties, the permanently-manned space station; and, finally, the representatives from the commercial and foreign customers which principally represent communications satellites.

I would like to discuss very briefly, as you start your hearings, three major topics: First, the magnitude of the problem; second, the complexity of the problem as we begin and continue to deal with it; and, finally, a little bit of the logic that we use in taking this magnitude and the complexity and try to sort out what is a logical and proper thing to do with the various customers.

I have a couple of Vu-Graphs, and, with your permission, I would like to show them and walk you through them so that you can first understand the general magnitude of the problem.

Can I have the first Vu-Graph, please? And I believe that you have a handout up there, if it would be more helpful to you.

What this Vu-Graph shows in graphic form is the launch demand as it existed on the day prior to the *Challenger* accident in January. It is plotted as a function of equivalent shuttle payload bays versus years, and it shows the sort of flight rates that we were projecting at that time.

Further, for example, in fiscal year 1986, where you see a plan of 13 or 14 equivalent shuttle bays, it shows by general customers what percentage of those payload bays made up that total load. And those general categories are the very witnesses that you will be having to testify in the next few days: Communications satellites, Government and foreign science—other Government payloads and foreign science—NASA payloads, and national security payloads.

I have in your handout, and I do not plan to show, but for you and your staff, a breakout of this same demand, not with regard to shuttle payload bays, but as a breakout with actual payloads. In other words, from 1986 to 1992, we are having to deal now with 251 payloads that are seeking access to space.

May I have the second slide, please?

I would now like to call your attention to what I believe is the second graph or the third sheet in your handout, and the one that is being projected now.

The previous outline of our demand is in the dotted line there, and what is projected here is a post-accident capacity of the shuttle system. The assumptions on this chart are, first of all, the first launch date that we reported to the President, which is the first quarter of 1988; second, flight rates that we have previously testified to your committee, which will be safe and sustainable; and, again, just as an example of one of the iterations that we have gone through in recent weeks, the sorts of percentages that these various classes of customers will typically expect to get over these coming years.

So, basically what you see here is capability in the lower part of this graph and backlog between our capability with three orbiters and the demand prior to the accident.

The next subject that I would like to discuss briefly—and I don't have a Vu-Graph, but I do have a handout that I believe that you have—I would like to discuss a little bit about the complexity of the problem.

If I could call your attention to this sheet, which I have entitled "Manifesting Fact Sheet," and spend a few minutes, I would like to describe for you how tough it is when we consider whether to put a specific payload, be it a DOD payload or a NASA payload, into a specific flight.

What is plotted here across the top, first of all, are the primary categories of customers: U.S. Government and civil, foreign, and commercial, and I have a similar sheet which is classified for Department of Defense payloads.

Second, what you see across the top are all those specific satellites and payloads, each one of them that represent our demand. They start in the far left with the tracking data and relay satellites and proceed across, as you see, for various science, and foreign, and commercial satellite programs.

Plotted down the left side of that factsheet is a number of factors that I and my staff have to consider to assign just one payload to just one flight. For example, right at the top, you will see under "Vehicles" OV- 102, 103, and so forth. Because the *Columbia,* orbital vehicle 102, is heavier than the *Atlantis* and the *Discovery,* there are certain satellites that cannot fly on it.

Finally, in this factsheet, certain satellites have certain upper stages which have particular requirements that we must meet as we plan a flight: for example, the inertial upper stage, the PAM-D, the PAM-D2, et cetera.

Further, some are spacelab modules. Some require particular services, like the remote manipulator system. Some, we have discussed commitments about payload specialists that are required; mission parameters, inclination, and apogee, and perigee requirements are different for each flight, and so forth.

So, it is not as simple as deciding between whether one satellite is more important than the other. We also must be sure that we have a vehicle and the capability at the cape to deliver a vehicle to the pad that matches that satellite. That is one of the problems, and I have discussed with you privately the difficulty in the problem, and I think this should provide you a little bit of an example of it.

Finally, I would like to talk a little bit about the process, itself. As you know, in general, we have set our national priorities. The most crucial are national security missions and then major NASA science payloads—particularly the planetary payloads that have windows that must be met because they are the most difficult to manifest. We start this process by first looking at the cape flow, laying out vehicle flow, and then beginning to iterate with the Department of Defense and with the NASA science, and with commercial and foreign, their priorities.

We do not set priorities within these major categories. They do.

I have personally sat down and discussed with Dr. Edelson, as an example, for NASA space science; Dr. Colladay, for space technology; and Mr. Hodge, for the space station, what their priorities are within their realm of expertise, and they can speak much better to those priorities than I.

I have, also, as recently as the latter part of last week, met with Secretary Aldridge, and General Randolph, and several others, to discuss the Department of Defense priorities.

These priorities change, and they will change as we go along. It is important to realize that this is an iterative process; it is a negotiated process. And even though we have general categories of priorities—for example, the most crucial national security missions are the first priority—the complexity of the vehicle flows still do not allow us, nor do I think it would be wise to fly off all of those before we got to the next general category. It just does not make common sense to do it that way.

So, the bottom line is: we have been working on this just as hard as we can. No one would be happier if I could come here today and give you a manifest for the shuttle program, but there are some other decisions to be made.

A good example, as you know, is that we recently and regrettably had to cancel the development of the shuttle Centaur Program. I spent this entire morning in a meeting dealing with the difficulties of alternatives for our planetary missions, which, incidentally, also includes a number of NASA centers and the Department of Defense as we look at various possibilities, and is heavily dependent on and very much affects the manifest itself because of the location of when we can develop those capabilities and, once they are developed, how quickly can we find a window for those payloads.

So, what I have tried to do today is, first, to point out the magnitude of the problem, the complexity of it, and a little bit about the process, and I would be pleased to answer your questions.

I think the bottom line is that we are going to fly just as soon as we can; we are going to be safe the day that we do it; and we are going to have a logical and proper manifest that balances these crucial, national priorities in a situation where the supply will not meet the demand.

Thank you, sir.

[The prepared statement of Admiral Truly follows:]

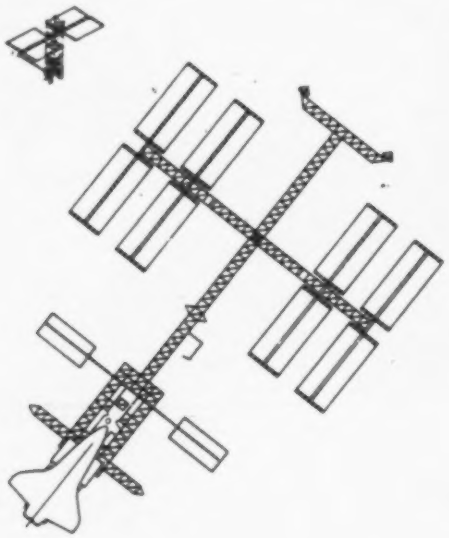
National Aeronautics and
Space Administration

Hold for Release Until
Presented by Witness

July 17, 1986

Subcommittee on Space Science and Applications
Committee on Science and Technology

House of Representatives



Statement by:

Richard H. Truly
Associate Administrator
for Space Flight

99th Congress

HOLD FOR RELEASE UNTIL
PRESENTED BY WITNESS

July 17, 1986

Statement of

Richard H. Truly
Associate Administrator
Office of Space Flight

National Aeronautics and Space Administration

before the

Subcommittee on Space Science and Applications
Committee on Science and Technology
United States House of Representatives

Mr. Chairman and Distinguished Members of the Subcommittee:

I am pleased to accept your invitation to testify before this Subcommittee about the Office of Space Flight's (OSF) planning and use for both the Shuttle and Expendable Launch Vehicles, and how payload priorities and policies have evolved since the Challenger loss. These issues are among the most complex and difficult that NASA must address. Before addressing this topic in more detail, I would like to bring you up to date on our current activity.

This week NASA submitted to the President its plan to implement the recommendations of the Presidential Commission on the Space Shuttle Challenger Accident. NASA agrees with the recommendations of the Commission and is actively implementing them. This implementation is taking us far on the path to resumption of Space Transportation System (STS) operations.

Because of the downtime necessary to implement these recommendations and the reduced flight rate resulting from the loss of the Challenger, a substantial backlog of payloads will exist for some period of time. Prior to STS 51-L, some 145 STS flights (consisting of 251 payloads) were manifested through 1992. With a 24 month standdown and a replacement Orbiter, the backlog will be approximately 75 STS flights which includes 30 STS equivalent flights of NASA payloads, 28 STS equivalent flights of DOD payloads, and some 17 STS equivalent flights of other payloads. The DOD plans to reduce their backlog during this period by some 16 equivalent STS flights by transferring payloads to ELV's. Although NASA is also considering offloading some payloads such as the planetary missions to ELV's, many NASA payloads cannot be offloaded.

The assignment and manifesting process for these payloads, as I mentioned earlier, is a very complex process. I would like to take a few minutes to discuss this process. There are a minimum of three levels of considerations which affect these payload assignments, including pre STS 51-L launch schedule, policy priorities, and mission parameters and performance criteria. The process of working conflicts and priorities for payloads within this context is both an interactive and iterative process involving customers, several NASA centers and Headquarters program offices, and other government agencies, primarily the DOD. These tradeoffs between the dedicated national security and dedicated major NASA science payloads, and between the remaining Shuttle capacity and classes of customers are very difficult decisions. Proposed changes are worked and reviewed by those organizations which are most likely to be impacted by a flight assignment change before recommendations can be finalized. The mechanism for implementing this policy is the Flight Assignment Working Group (FAWG), established in October of 1977, which processes payload requests for flight assignment into a preliminary STS cargo manifest.

Our current Shuttle manifesting process must take into account the downtime necessary for corrections and fixes, the limited launch capability of a three orbiter fleet and the possible fourth orbiter replacement, the requirements for launches from Kennedy Space Center (KSC) and Vandenberg Air Force Base (VAFB), and the establishment of a safe and realistic flight rate. Factors such as orbiter lift capability, turnaround time of airborne support equipment, and turnaround of classified ground support facilities influence the sequencing of the payloads assigned to the mission.

The current manifest development activity reflects our best efforts at meeting commitments to all customers for which we have contractual commitments or official authorizations. The request dates of customers are now being considered in the context of NASA's current policy priorities which are: (1) critical national security payloads; (2) major scientific payloads including those with specific launch windows; and (3) other U.S. Government, foreign and commercial payloads. The existing inventory and long lead times for procurement of additional Expendable Launch Vehicles (ELV's), possible uses of Complementary Expendable Launch Vehicles (CELV's), affect the request for Shuttle flight assignments. The question of whether or not the Shuttle will continue to offer routine commercial spacecraft deployments and the timing of a transition is under review at this time in the interagency process.

The scheduling of nonprimary payloads (i.e., GetAway Special (GAS), middeck, and Hitchhiker) is more difficult because these payloads are manifested on a space-available basis after primary payloads have been determined. There is a considerable demand for nonprimary payload space, but limited flight opportunities exist because of Shuttle constraints (i.e., Shuttle lift weight, Shuttle center-of-gravity limits, flight plan conflicts, etc.).

We have just reported to the President that the Shuttle will not be launched again until the first quarter of 1988. The Tracking and Data Relay Satellite (TDRS) is planned as the first payload to be flown once STS operations are resumed. When we have a revised manifest ready we will be pleased to provide it to the Committee.

NASA has contractual agreements for launch of 45 commercial and foreign payloads, of which 8 are shuttle unique and 37 are communication satellites. All of these payloads will be delayed more than the actual downtime.

While there is some Delta ELV hardware that might be used in the near term to alleviate the delay of some payloads, the minimum time for new production of any ELV's is 27-30 months. A number of our customers have turned to ARIANE for launch service. Several of these have already signed contracts for ARIANE launch services, but none has yet taken advantage of the Shuttle Launch Service Agreement (LSA) terms which permit them to walk away with full refund (except optional service charge) if the delay is 9 months or greater from the LSA date.

All to date have indicated a desire to maintain their Shuttle slots. As you are aware, the issue of transitioning routine commercial spacecraft deployment to ELVs is being considered by the Commercial Space Working Group under the Economic Policy Council.

In 1983, the President established the policy on commercialization of expendable launch vehicles. We support that policy and the principle of a mixed fleet. NASA is continuing discussions with the DOD regarding the availability and possible use of Complementary Expendable Launch Vehicles (CELV's), Titan 34D7's, for NASA planetary payloads such as Ulysses and Galileo. We are considering and evaluating all possible alternatives for launch which will allow the greatest potential for Shuttle manifesting and launching payloads, both primary and secondary.

Mr. Chairman, this is the end of my prepared testimory. I would be happy to answer your questions.

[The "Manifesting Fact Sheet," "Orbiter Flight Sequence Sheet," and Vu-Graph briefing sheets follow:]

NOTES FOR MANIFESTING FACT SHEET

OPERATIONS

O1 TDRS NEEDS TWO ON STATION PLUS ON-ORBIT SPARE FOR FULL OPERATION

O2 LANDSAT BASELINED AS PLATFORM FOLLOWED BY SERVICING FLIGHTS

SCIENCE

S0 CONTINUING SERIES

S1 SLS-1 IS FLIGHT-READY AT KSC

S2 SPACELAB J: 45% JAPAN, 55% US

S3 SPACELAB D2: 70% GERMAN, 30% US

S4 USES RTG'S FOR POWER

S5 HUBBLE SPACE TELESCOPE PLANS 3 YEAR REVISIT CYCLE, WITH CALL-UP ON NEED. REVISIT INCLUDES ALTITUDE REBOOST.

S6 LOWER ALTITUDE FOR GRO WOULD ACCELERATE NEED FOR RESUPPLY FLIGHT

S7 ROSAT IS A COOPERATIVE PROGRAM WITH W. GERMANY

S8 ASTRO 1 IS FLIGHT-READY AT KSC

S9 LDEF 1B MAY BE REPACKAGED FOR EASIER MANIFESTING

S10 EUVE IS PLANNED TO RE-USE THE MMS RETRIEVED WITH SMM

S11 XTE (X-RAY PULSAR OBSERVATION) USES INSTRUMENT CHANGEOUT WITH EUVE

S12 SPARTAN FREE FLYER RETRIEVED ON SAME MISSION

S13 SPACE PLASMA LAB: SUBSATELLITE AT 100 KM SEPARATION; DEPLOYMENT OF 300 METER DIPOLE ANTENNA, 2 SHIFT OPERATION, DECEMBER SOLSTICE/NEW MOON LAUNCH WINDOW, 77°;243 x 175 NM ORBIT. SPECIFICS NEGOTIABLE

S14 UNCONTROLLED REENTRY OF LDEF FORECAST NOT EARLIER THAN 1990

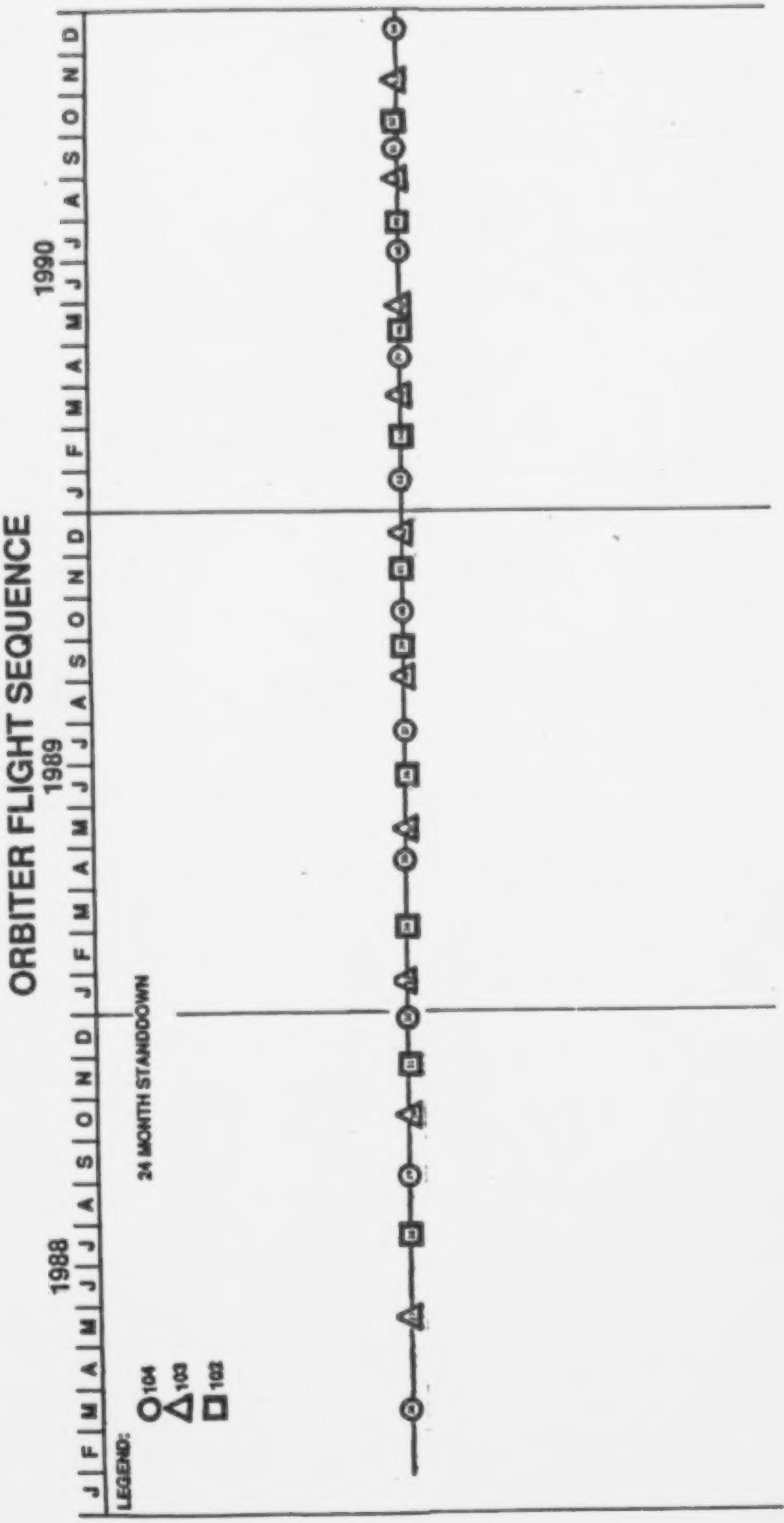
COMMERCIAL AND FOREIGN

	PALAPA B3	WESTAR VI S	INSAT 1 C/D	ASC-2	INMARSAT II 1/3	GEOSTAR	SKYNET 4	GSTAR III	STC DBS-A/B	RCA 3001	HC-9 to 18	SBS-6	SYNCOM IV-5	INTELSAT VI 1/2/5	RCA 4001/4/5/6
NUMBER OF PAYLOADS	1	1	2	1	2	3	2	1	2	1	10	1	1	3	4
NOTES															
C1 STD NOON/MIDNIGHT GMT±30 min NON-STANDARD	S	S	N	S	S	S	S	S	S	S	S	S	S	S	S
C2 PAYLOAD SPECIALISTS	1	-	2	1	-	-	2	-	-	-	6	-	1	3	1
C3 LOAD FACTOR	.18	.16	.16	.16	.16	.16	.22	.22	.18	.18	.26	.26	.27	.48	.25
C4 ELV DELTA, upr, ARIANE	DA	DA	DA	DA	A	DA U	DA U	DA U	DA	A	A	A	-	A	A
C5 DOD INTEREST							X						X		
C6 LONGITUDE RQMT MAY IMPACT CREW SLEEP PERIOD			X												
C7 190 NM ALTITUDE	X	X	X	X	X										
C8 DESIRED NEXT LAUNCH DATE	6/ 86	6/ 86	9/ 86	1/ 87	7/ 88	1/ 90	5/ 88	12/ 88	11/ 87	11/ 94	7/ 88	11/ 87	9/ 86	8/ 89	3/ 89

MANIFESTING
FACT
SHEET

NASA Headquarters
CUSTOMER SERVICES
DIVISION
STS MANIFESTING

U.S. GOVERNMENT/CIVIL		FOREIGN AND COMMERCIAL
OPERATIONS	SCIENCE	
[illegible]	[illegible]	[illegible]


ORBITER FLIGHT SEQUENCE

7/14/86
MC 8247-20

NASA OFFICE OF SPACE FLIGHT

BRIEFING TO

Subcommittee on Space Science and Applications

Committee on Science and Technology
House of Representatives

STATEMENT BY:
Richard H. Truly
Associate Administrator
for Space Flight

July 17, 1986

7/14/86
MC 8247-16

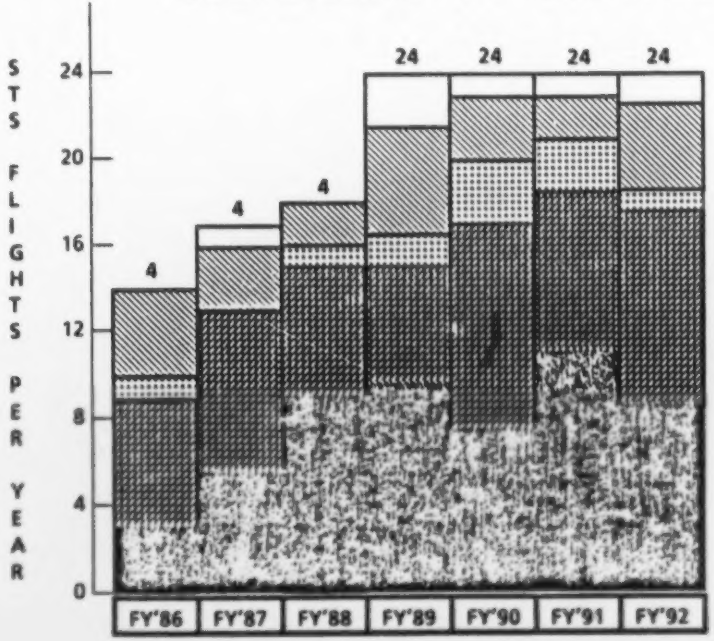
NASA

OFFICE OF SPACE FLIGHT

PRE 51-L STS PROGRAM
LAUNCH DEMAND

SPACE SHUTTLE

STS FLIGHTS -FY 1986 THRU FY 1992



NOTES:

	FY'86 THRU FY'92 TOTAL
☐ Reserve	4.8
▨ Communications Satellites	19.1
▦ U.S.Govt / Foreign Science	8.6
▩ NASA	55.8
■ DOD	56.7
TOTAL	145.0

NASA

OFFICE OF SPACE FLIGHT

LAUNCH DEMAND

SPACE SHUTTLE

PRE 51-L PAYLOADS SCHEDULED FOR LAUNCH FY 1986 THRU FY 1992

CUSTOMER	Number of Payloads	Percent
DOD	66	26
NASA	132	53
U.S. Govt/Foreign Sci	16	6
Communication Satellites*	37	15
TOTAL	*251*	*100%*

*INCLUDES ONLY THOSE UNDER CONTRACT

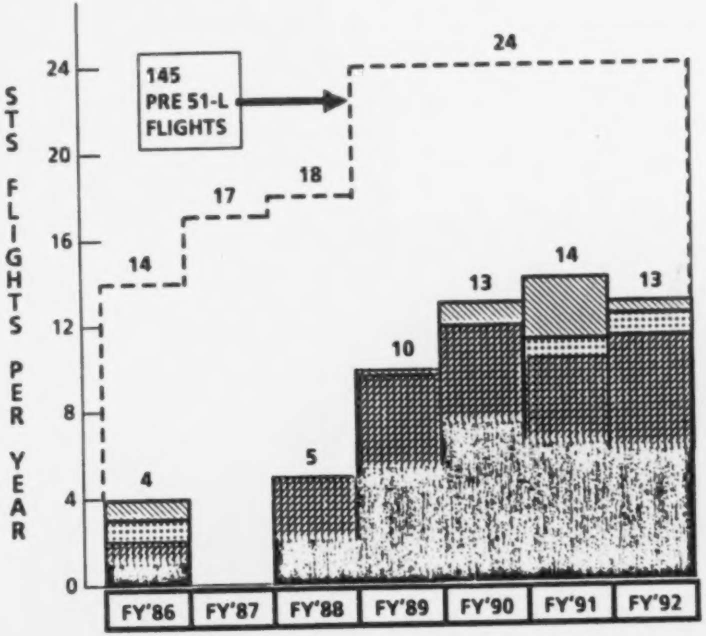
7/14/86
MC 0247-6

NASA

OFFICE OF SPACE FLIGHT

POST 51-L STS CAPABILITY

24 MONTH STANDDOWN ASSUMPTION
PRELIMINARY ESTIMATE



NOTES:	FY'86 THRU FY'92 TOTAL
☐ Reserve	0.0
▨ Communications Satellites	5.8
▦ U.S.Govt / Foreign Science	2.8
▩ NASA	22.5
■ DOD	27.9
TOTAL	59.0

Mr. Nelson. Before we continue on on this subject, would you just give us a little synopsis of your thinking with regard to the redesign of the SRB joint, and how that thinking led you to the decision that it would be first quarter 1988.

Admiral Truly. Yes, I would be pleased to.

As you know, even before the Commission reported out, we had formed a solid rocket motor joint redesign team, which involves not only the Marshall Space Flight Center, but other NASA centers. We quickly formed an expert advisory panel which includes other contractors other than the prime contractor, Morton Thiokol. It is essentially made up of people about half from NASA and half from industry.

Later, Dr. Fletcher requested that the National Research Council form an oversight committee, which has now been at work for several weeks. Obviously—and I believe that this is what we can do, and do safely—the fastest way to assure access to space is to use that hardware which is most available to us, and we are trying very hard to do that very thing.

We have not picked a design. We have scheduled a preliminary design review, if I recall, toward the end of September. We have had a number of meetings with the National Research Council Oversight Committee. We have some big decisions to make.

If you recall, one of the recommendations, as an example, that was made by the Rogers' Commission, was that we consider carefully the testing mode, be it vertical, with the nozzle up or down, versus horizontal, to verify the adequacy of that joint, because the testing is the proof of the pudding.

We are going through that study very carefully now. As a matter of fact, today and tomorrow, our redesign team is briefing the oversight committee on that very issue, and I hope within the next 2 to 3 weeks we will be able to make a decision.

Since we set what I had hoped to be, our best-effort schedule of July 1987 several months ago, we have spent a lot of effort and made a lot of progress in the analysis of this design, in the coordination with the prime contractor looking at hardware schedules, test schedules, and so forth.

And it was based on that work that now it is clear that we were overoptimistic when we set the July 1987 goal. Sometime in the first quarter of 1988, and that even represents 7-day work weeks and 3 shifts a day on the most crucial long poles in the tent, is more realistic. Specifically the availability of case hardware for testing, the availability of test stands to do full-scale motor tests, and the tooling that is required to fabricate the complex moulding that will be required interior to the field joint and to the nozzle joint to protect that joint from the hot gases will be the determining factors.

Mr. Nelson. At what point will you get a decision on which position you will test the redesign joints?

Admiral Truly. We are briefing the oversight committee on the status of that today and tomorrow. Our study will be complete, as I recall, in the next 2 to 3 weeks, we project. What I intend to do then is review the final results of that study, get back with the oversight committee and make a decision.

The other thing that I should point out is: As you know, the latest Titan 34-D accident was caused not by the same causes as ours, but I want to assure you that we are treating that mishap as if it were our own.

As we had Air Force representation on the NASA Task Force, as we investigated the *Challenger* accident, we also have had NASA representation on the accident board that investigated that one.

So, we are treating that just as they are and paying a lot of attention to it.

Mr. NELSON. And did you say that by November, you expected to have the selection of the redesign?

Admiral TRULY. We are going to have a preliminary design review to go into testing the latter part of September or around the first of October. The critical design review—and I don't have that schedule in front of me, but I will be pleased to provide it to you—as I recall, is after the turn of the year. I am sorry, I don't remember.

[The material referred to follows:]

Presently, the solid rocket motor redesign preliminary design review will be completed the first part of October 1986, and the critical design review completed by mid-May 1987.

Admiral TRULY. It will be at the critical design review that we actually select the final design. However, in order to go into testing, we will have a design that we will prove by test at the preliminary design review.

In the event, I should point out—may I make one more final point?

Mr. NELSON. Surely.

Admiral TRULY. I should point out one other thing. In the event that we get into testing and have a test failure along the way, we are also starting an effort strictly as a contingency to look at alternate designs that do not depend on our presently available hardware. And I think that is the prudent thing to do, because if we get to that point, obviously we will have gained many, many months.

But I am personally convinced that in the data that I have seen so far, that we can use our hardware, and we can get to flight quickest, as you have seen from this manifest discussion, which is very crucial to the Nation, by proceeding down the route that we are.

Mr. NELSON. And if there were a failure during the test, there is no built-in cushion that would cause considerable other delays, would it not?

Admiral TRULY. Naturally, it would depend upon the circumstances and whether or not design change could be made depending on specifically what happened, but, in general, to answer your question, yes, this is a difficult test schedule, and the thing that makes it so darn long is the availability of hardware to go into test, and then simply the availability of test stands and people to conduct the tests.

We plan to begin to load and mix the propellants for the flight at the time of the CDR, and, at that time, we will still have at least two full-scale motor firings to go. So, if we run into a major test problem, we will be further delayed.

Mr. NELSON. Now, what has happened to the time that we were supposed to be gaining over the course of the last several months in the redesign? That was presented to this committee several months ago, as time that we would be gaining because of the redesign effort that was already underway.

Admiral TRULY. I think a great deal of time has been achieved. It is just that we are dealing with a failure that is one of the longest lead items in this complex system. When I came and testified before, I testified that the schedule that we were hoping to make was a complete success schedule, one that was very difficult to make, and we had many concerns with it.

No one was more disappointed than I to find, as we went along, that we could not make it and that we had to go to the first quarter of 1988, because I appreciate very much the crucial demands to get back into flight. But the months that we have been able to spend in this design have been very productive, and we have already begun to do a number of tests. We have gained several months on the design of test fixtures. We have dealt with the difficulties, as you know, of the investigation, itself, and we have begun for the last month or so to work with the oversight committee.

So, I think if we could not have started that process until after the Commission reported out, we would simply be 3 or 4 months down.

Mr. NELSON. Admiral, the members of this subcommittee are intensely interested in the redesign process. Will you consult with this committee before you make any final decisions on the redesign?

Admiral TRULY. I will be pleased to brief this committee on our progress in the redesign efforts at your pleasure.

Mr. NELSON. OK.

Now, for the record, before we go to General Randolph, for the record, we have recently heard of some activity in the Senate and the House Armed Services Committees regarding the request by NASA and the Defense Department to continue the payments through fiscal 1987 from the Department of Defense to NASA for future launches.

Why don't we get you and General Randolph to state for the record the position of NASA and the Air Force?

Admiral TRULY. We have, over the past several months since the accident, dealt with the Department of the Air Force on this specific issue, and, early on, agreed that between the DOD and NASA and worked it with the OMB, that the proper resolution of that situation, because of the point we were in the budget process, was to let stand the fiscal year 1987 what are termed reimbursements from DOD to NASA, so that we could work in the appropriate credits in the development of the fiscal year 1988 budget.

In recent days, we have discussed that again, as late as last Thursday, I think, and Dr. Fletcher and Secretary Aldridge jointly signed a letter that restated that agreement between the DOD and NASA.

Mr. NELSON. Do you want to add anything to that, General?

General RANDOLPH. Yes, sir.

First of all, we absolutely agree with what Admiral Truly just said. The Secretary, indeed, did sign a letter last Thursday to various Members of Congress, restating his position, and that position is that we have previously agreed with NASA that we would make these payments because they are, indeed, a part and parcel of the overall NASA budget, and that credits would be taken up sometime in the future, recognizing that we are not flying at this time, but, in order to not be disruptive, we felt that the proper process was to make the payments and then address the credits as the budgets of the future are put together.

And we stand on that position, sir.

Mr. NELSON. OK.

We will recess the hearing here. I will run and go vote, and then we will resume, and we will start with you, General Randolph.

General RANDOLPH. OK.

[Recess.]

Mr. NELSON. Let's resume.

General Randolph, right when we broke for the recorded vote, I was asking your comments about the Armed Services Committee.

While I was over there on the floor, I got the schedule for the upcoming floor activity, and we have the DOD authorization bill that is coming to the floor on August 5th.

Now, what if we don't get the committees—the House and the Senate—to reverse this preliminary action that they have taken, and, in fact, it comes to the floor with the provision whereby the payment schedule from the Air Force to NASA is not included within that DOD authorization bill.

If that is the case, of course, we are faced with a choice that we have got to fight it on the floor. Will we have the Air Force backing us up in such a fight on the floor?

General RANDOLPH. Mr. Chairman, again, I go back to the statement that I made earlier, and that is that the administration requested the money, we would hope that the Congress would approve that money; the Secretary has stated in a letter to several Members of Congress that we believe that that is the right thing to do. It is certainly consistent with our agreements with NASA, and, in fact, we believe it is very important to NASA that we be allowed to do that, because it becomes disruptive to NASA's ability to work the shuttle problems if they don't have the money.

So, it is not in our interest to not have NASA receive the funds in accordance with our agreement. So, that is clearly not outside of our interest to have that happen. So, in that sense, if that is what you mean by backing, yes, sir.

Mr. NELSON. What happens if, in the final result, we were not to prevail, or, as a matter of strategy, that we chose not to make that an issue on the floor, and such payments were not authorized under the DOD authorization bill? Would the Air Force still make the payments, anyway?

General RANDOLPH. Well, it is interesting. I was just asked that question. Obviously, the Air Force has very limited authority. All the authority that we have comes from the Congress, so if the Congress does not approve the money, then all the Air Force can do is re-request the funds, which would be, of course, asking again that the Congress approve the funds. But clearly, we have no option to spend money that is not authorized and appropriated by the U.S. Congress.

Mr. **Nelson**. OK. Let's go back now to the original subject of this hearing and have you give your statement to us, please, sir.

General **Randolph**. All right.

STATEMENT OF GEN. BERNARD P. RANDOLPH, DEPUTY CHIEF OF STAFF, RESEARCH, DEVELOPMENT AND ACQUISITION, DEPARTMENT OF THE AIR FORCE

General **Randolph**. Mr. Chairman, of course, I am also very pleased to be here before this subcommittee this afternoon, representing, really, the Secretary of the Air Force, who, as you noted, is out of town this week.

So, I have a formal statement, which I would like to submit for the record, and, if I may, I would just like to informally summarize that and talk to a few of the points that you asked us to discuss in your letter to us.

The question that you really ask was for us to talk about our needs, the DOD needs, and the planning that is associated with use of the shuttle and expendable launch vehicles, and I believe that it is best if I talk a little bit, first of all, about what the condition of our Constellations are on orbit and then move into the recovery plan that we have developed, and the Congress has approved for 1986 and 1987.

Right now, all of the missions that we are required to perform on orbit are being performed, and that is an important factor.

The problem that we have, however, is that we normally have robust Constellations so that we can accommodate the failures which are inevitable with satellites that have been on orbit for a long period of time.

Unfortunately, because of the Titan failures and because of the loss of the Challenger, we are now in a position where we are dependent entirely on those assets that are on orbit today, and any failures from this point forward will cause us some problem.

Now, I was very careful to say some problem, because the degree of the problem depends on the Constellation and depends on the mission that is actually being performed.

Now, what do we do about all of that?

Well, you have heard already that, as a result of the 51–L loss, we are now down until early 1988 with the shuttle.

What the Air Force asked the Congress to do, and the Congress agreed, was to allow us to purchase some additional expendable launch vehicles to help with the recovery program.

When the launches begin again with the orbiter, we will be nine payloads—have nine payloads in the backlog at the beginning of that year, 1988. In addition to that, we already have a requirement for eight payloads to be launched during 1988.

So, as you can see, it is going to be very difficult to catch up, and, in fact, we will reach the point by 1989 where we will have a maximum, depending on the situation, of some 16 to 17 satellites in the backlog queue, waiting to be launched. So, as you can see immediately, it is clearly a very serious problem to us.

Now, let me talk a little bit about the recovery program and three parts of the recovery program.

First of all, we had—the Congress some time ago approved a system called the complementary expendable launch vehicle. If you will recall, Congress approved our buying 10 of those, and that program has already started, and, in fact, late in 1988, we will be ready to begin launching with that complementary expendable launch vehicle.

In the recovery program, the Congress approved an additional 13 of those complementary expendable launch vehicles, and, if you recall, we had a competition between those people who make, the Atlas booster and those that make the Titans, the Titan I; so, we now designate the CELV as Titan IV. So, from this point forward, when you hear the term Titan IV, which I will use for the remainder of this discussion, that is what I am talking about.

Mr. NELSON. I am glad you explained that.

General RANDOLPH. Yes, sir.

Mr. NELSON. Now, your initial buy was 10.

General RANDOLPH. Yes, sir.

Mr. NELSON. And you are saying an additional 13——

General RANDOLPH. Additional 13.

Mr. NELSON. Are planned for, of which you have the money to start those——

General RANDOLPH. Yes, sir.

Mr. NELSON [continuing]. In fiscal year 1986 supplemental, which has just been—that has already been signed.

General RANDOLPH. Yes, sir; that has already been signed, and, as a result of that urgent supplemental, we have that capability.

Now, what we would like to drive toward is to establish a level, if you will, of launch capability with the Titan IV, and we are thinking in terms of about five to six Titan IV launches each year in order to meet our requirements along with the shuttle. I will get to the shuttle and how we plan to use the shuttle, in a couple of minutes.

Mr. NELSON. Five or six Titan IV's a year.

General RANDOLPH. Five or six Titan IV's a year, yes, sir.

Mr. NELSON. For 5 years.

General RANDOLPH. For the foreseeable future. We will come back to Congress and ask for additional vehicles until such time as we believe that is no longer necessary.

The second thing, of course, as you will recall, that we had in the recovery program is a thing called the medium lift launch vehicle, or MLV, which is the abbreviation that we use for that, and that vehicle is something that is capable of lifting payloads larger than those that could be lifted by the old Titan II, that is, the refurbished ICBM's that we are taking out of the hole, but smaller than those that you would expect to put on the Titan IV.

Now, that has an interesting capability, because it turns out that many of the commercial payloads fall into that category. So, the MLV has the dual purpose of being able to handle some of our medium payloads, such as the navigation satellites, and, indeed, that is what we intend to launch on the MLV initially, and it also has the capability of potentially being a commercial expendable launch vehicle.

Now, we are working that issue with the Department of Transportation, and in our request for proposal, which has already been released, we specifically ask the offerors to tell us about how they would do commercial launches, and the reason for that is clearly if the business base is larger, and if they can take care of commercial launches, that is of benefit to the U.S. Government. So, we are interested in that, and we want to know how they go about doing that.

I, of course, must point out that we intend to follow, obviously, all of the laws. That is, we do not intend to use any Government funds to support commercial enterprise, but we intend to facilitate to the extent that is appropriate and allowed for in the law to the maximum extent to facilitate that commercialization.

Mr. **Nelson**. Let me stop you there, General Randolph, and ask Admiral Truly something.

Now, this is an interesting thing. We have this RFP coming out from Pete Aldridge for this medium-weight launcher; that because of the Government investment by the DOD, then the startup costs are there, and, therefore, they might become a viable potential commercial launcher.

At the same time, in my opening remarks I alluded to the Palapa satellite launch by the Delta, and there are some suggestions there that some additional Deltas be opened up there, trading off some SDI payloads, and maybe some more commercial satellites; so, conceivably you could have two different commercial launchers viable as commercial launchers coming out because of increased Government production.

Now, let me throw one other ingredient into the stew. The fact is that Mr. Al Rockwell wants to consider having the private financing for an orbiter, of which he testified before this committee that he wants to be able to market cargo bays for commercial satellites.

Now, if I count them up, we are talking about Deltas; we are talking about the winner of the competition for the MLV's; and now we are talking about the private financing of an additional orbiter, or existing orbiter, and marketing its cargo bay for commercial satellites.

Have we overextended ourselves in our capacity and in supply and demand it is going to be difficult; you are going to have more launch supply than you are demand?

Mr. Gillam, get into it if you would like to.

Admiral **Truly**. I was going to say, on the part of your question that has to do with commercialization, I would prefer to ask Mr. Gillam to comment, but I would—let me trace it from my point of view.

The development by the Air Force of the medium launch vehicle is going to be a great assist to the access-to-space need that we find ourselves in, and the construction of the Deltas that we have the hardware for is going to be the same. There is no way that the development, those two developments, is going to cause the launch supply in the next few years to catch up with the demand——

Mr. **Nelson**. OK. So the——

Admiral **Truly** [continuing]. Although they certainly will help, and we support the concept, and have continually testified that we do support the concept, of a mixed fleet and to assist in the commercialization.

But I would prefer to pass that part of it to Mr. Gillam, since that is his, rather than mine.

Mr. NELSON. OK. Let me clarify the question, because certainly in the near term, you have got this tremendous backlog, and you have got to get them plumb. And so we are looking for a way to do that in the near term. Say, in the near term we define it between now and 1990. But at some point, General Randolph's and Mr. Aldridge's medium-weight launcher is now in production, and it has been bid upon with the RFP in mind that says a commercial vehicle will come out of this, and so that would be somewhere around what, 1990, that it might be ready? 1989?

General RANDOLPH. 1989.

Mr. NELSON. OK. So now, do we have in that time period, do we have an oversupply of ability to launch commercial satellites. I am talking about commercial satellites, with the goal in mind of having a viable commercial American capability to launch.

General RANDOLPH. Yes, sir.

Sir, may I just clarify one point?

Mr. NELSON. Please.

General RANDOLPH. The RFP does not say that there will be a commercial launch vehicle.

Mr. NELSON. I understand.

General RANDOLPH. The RFP says we encourage that.

Mr. NELSON. I understand. I understand. But that is clearly one of the purposes of the RFP.

General RANDOLPH. Yes, sir.

Mr. NELSON. Mr. Gillam.

Mr. GILLAM. I was about to say, Mr. Chairman, unfortunately, I understand the question that you are asking.

Mr. NELSON. Bless you. [Laughter.]

Mr. GILLAM. It is entirely possible that there will be an excess of U.S. capacity if you make the assumption that all of those things come to pass. That excess of capacity will probably occur at the best estimate around 1991, 1992, if all of those things happen.

If we are operating a commercial Atlas Centaur, a commercial Delta, a commercial MLV, and a privately operated orbiter, there is no doubt we will have an excess of capacity for the commercial and foreign market, and that the market will be unable to sustain or to support that level of capacity.

Mr. NELSON. And an Arian, and a Chinese launcher, and a Soviet launcher.

Mr. GILLAM. And, if possible, a Japanese launcher coming in about 1994.

Mr. NELSON. Yes, sir.

OK. What do we do? What is your recommendation?

Mr. GILLAM. I am not prepared to make a recommendation in that regard. I think the posture would be that the marketplace would determine the survivors, and it will be survival of the fittest.

Admiral TRULY. Mr. Chairman, can I come into this?

Mr. NELSON. Who's the fittest? Does it take a big Government subsidy?

Yes, sir.

Admiral TRULY. I just want to make one point. This conversation does skirt around the fact that the total launch demand is huge compared to supply, even with these vehicles, in 1990. You phrased the short-term problem of backlog and mentioned the year 1990, or so.

I believe that the backlog problem goes into the midnineties.

Mr. **Nelson**. OK. Now, do you agree, Mr. Gillam? Is that when you have the oversupply, in the midnineties?

Mr. **Gillam**. Well, the total backlog problem——

Mr. **Nelson**. On everything?

Mr. **Gillam** [continuing]. On everything goes well into the midnineties.

Mr. **Nelson**. All right, now, how does that——

Mr. **Gillam**. And a fourth shuttle that was privately financed, frankly, I don't think would be filled up with commercial satellites.

Mr. **Nelson**. Sure.

Mr. **Gillam**. It would be filled up with many things based on national priorities that fall into the very categories that we mentioned before.

Mr. **Nelson**. OK.

Well, Mr. Gillam, you and I both understand the question, but neither one of us understands the answer yet. And that is what we are trying to get.

Mr. **Gillam**. I clearly have no answer to the last question that you asked.

Mr. **Nelson**. Well, none of us will until we see how some of these pieces start falling into the puzzle.

OK. General, please proceed.

General **Randolph**. Yes, sir.

Along that line, I just might mention that also the DOD backlog continues well into the midnineties, so we are a long way from reaching the point where we have the launch capability to completely work off the backlog.

The third part of the recovery—if you recall now, I have talked to two parts: the first being the Titan IV; the second being the MLV—the third part of the recovery program is to design or alter the design of our satellites so that we can have a dual capability; that is, that the satellites could be launched either on the shuttle or on an expendable launch vehicle to give us the flexibility in the event of problems in either case to continue to have that assured access to space that you refer to in your opening comments.

Now, with that generalized view of the recovery program, let me just talk a little bit about procedures and how we procedurally will then move forward and work with the folks on the shuttle.

First of all, in just looking at the situation, we have got navigation payloads, we have got treaty monitoring payloads, we have got early warning payloads, we have got communications payloads, and we have got weather satellites. So, we have got a whole host of vehicles that need to get up there in order to continue the mission, and, right now, the situation is such that we have six Titan 34's remaining to launch some payloads. And, by the way, in my count, every one of those Titan 34's is spoken for, so I did not count the backlog. I did not use those boosters in counting the backlog.

We hope to be able to start launching those again in the beginning of next year, and I think you are familiar with our assessment of the failure problem; that is, it was not a design problem; it had to do with manufacturing or quality—we are not sure which—but we believe that by proper inspection and proper rework, we will be ready, hopefully, to launch early in the next calendar year.

That will begin to help with some of the immediate problems that we have, but, of course, it will be a long time before we reach the point where we will be able to work these things off.

What we will then do after we have gone through that is, we will work with NASA on the manifest, and we already have been working with Admiral Truly and his people on the manifest so that we can try to identify those payloads that we think are most urgent for us to fly.

Now, as Admiral Truly said, we in the Air Force look upon this as a national problem, not as an Air Force problem; that is, we, indeed, work very closely with NASA. It is a negotiation process. It is not a we-demand, as DOD, but it is how best do we solve this national problem.

In the early years, we are in general agreement with NASA that it looks like the DOD—and you saw this on the chart—will use about half of the capability of the shuttle. As time goes on, and we begin to work off the backlog, we will drop back to that one-third that we agreed to use a long time ago, and we intend to continue to use well into the near future—well into the distant future, as a matter of fact.

So, that is how we stand in terms of the priorities, and how we are planning, and how we are working the problems with NASA.

Let me just touch very briefly on some of the other things that you asked. You asked about payload prioritization. I think I have covered that. You asked about the DOD backlog. I think I have generally covered that, and you understand, Mr. Chairman, I cannot really get into specifics in this forum.

You asked about the effect of the Centaur cancellation. That, of course, is going to cause us some serious problems. We have already started our planning, but we have not finalized how we are going to react to that. But initial planning, for example, the communications satellites—Milstar—which was at one time supposed to be a shuttle Centaur launch, obviously has to come off the shuttle because of it's size. We must have the Centaur as the intermediate stage, so we are going to move that to the Titan IV. It will become a Titan IV Centaur.

That is the first decision affecting the Centaur cancellation.

Other payloads we may be able to make changes such that the inertial upper stage could be used as opposed to the Centaur, and we are in the process of looking at that right now.

So, my bottom line on the Centaur is that it is a problem; we understand the problem, and we are working now to try to determine specifically how we are going to work around that problem.

I think I have covered the RFP for the medium launch vehicle. I am certainly willing to answer any further questions on that.

And, finally, you asked if NASA would have access to Titan IV's, and the answer is, of course, yes. And we are, in fact, discussing right now with NASA some requests for expendable launch vehicle support, and how we provide that, and we are in the process again of negotiating the situation there.

Mr. **Nelson**. So how many a year are you going to have of the 34-D?

General **Randolph**. Right now, there are six Titan 34's left, and once those are gone, that is the end of that.

From this point forward, the only Titans, unless there is some form of Titan that wins the MLV, the only Titans we will have are the Titan IV's, and those will be in the five- or six-per-year regime.

Mr. **Nelson**. And the refurbished Titan II's.

General **Randolph**. And the refurbished Titan II's.

Now, the refurbished Titan II's, as you will recall, they are very small. They are big enough to launch our weather satellites, but that is about as large a payload as they can have. And, if you recall, the weather satellite is somewhere in the 50-100 pound category.

[The prepared statement of General Randolph follows:]

DEPARTMENT OF THE AIR FORCE

PRESENTATION TO THE

HOUSE SCIENCE AND TECHNOLOGY COMMITTEE

SPACE SCIENCE AND APPLICATIONS SUBCOMMITTEE

17 July 1986

STATEMENT OF: LT GENERAL BERNARD P. RANDOLPH
DEPUTY CHIEF OF STAFF FOR
RESEARCH, DEVELOPMENT & ACQUISITION

NOT FOR PUBLICATION UNTIL RELEASED
BY THE COMMITTEE ON SCIENCE AND TECHNOLOGY
HOUSE OF REPRESENTATIVES

MR CHAIRMAN AND MEMBERS OF THE COMMITTEE:

I appreciate the opportunity to appear before you to discuss the national space launch recovery effort. Let me emphasize that this is a national problem. We are working together with the scientific and commercial communities to recover our lost space launch capability and adopt a national strategy to ensure maintenance of this capability in the future. The manifesting of payloads on the Shuttle and expendable launch vehicles (ELV) and the priority issues that the nation will face must be considered in the context of the total launch recovery plan.

Our current inventory of launch vehicles includes 3 Shuttles and roughly 40 ELVs. These ELVs are the Titan 34D, Atlas, Delta, and Scout. The nation must rely on these assets to meet our near term launch requirements. No new launch vehicles will be available until late 1988.

For the next three years, our only heavy-lift capability will be the Shuttle and the Titan 34D. Both these systems as well as the smaller Delta are currently grounded. However, once the Shuttle and Titan 34D resume operation, they will again form the backbone of our space heavy-lift launch capability. The smaller ELVs (Atlas and Scout) currently comprise our sole means of space launch. All these ELVs — heavy-lift and smaller-lift — already have payloads assigned and cannot be readily remanifested. Furthermore, current plans call for phase-out of the Atlas, Delta, and Scout production lines.

Since 1985, when the Shuttle first became an operational system, the number of DoD flights per year increased with a corresponding decrease in ELV missions. DoD was dedicated to a minimum of 1/3 of all Shuttle flights. With this growing dependence on the Shuttle and our declining use of ELVs, we now face a very serious problem with the loss of the Shuttle. Mission slips and a reduced Orbiter fleet cause a significant backlog of payloads. This backlog problem becomes more apparent when we compare national Shuttle launch requirements and capabilities. For example, assuming the NASA planned flight rate of 15 flights per year with a three Orbiter fleet, by 1990, the nation will have payloads amounting to approximately 45 Shuttle bay equivalents waiting to be launched. This problem becomes more acute when Space Station missions are added to the Shuttle's manifest and if a decision is made to develop, produce, and deploy a ballistic missile defense.

Since the Challenger accident, NASA and DoD have worked closely to develop a revised Shuttle and ELV flight plan in support of our continuing national launch requirements. Both agencies have agreed to a Space Launch Recovery Plan as the basis for mission model planning. This plan includes a fourth Orbiter in FY 1991; procurement of 13 additional CELVs (which we plan to designate Titan IV) to establish a production rate of 5-6 per year with an initial launch capability (ILC) in FY 1989; and procurement of 12 medium launch vehicles (MLV) to establish a production rate of 4 per year with an ILC in FY 1989.

The thrust of the national recovery plan is to provide an assured access to space. The Shuttle will remain one of the primary launch vehicles for DoD. However, we in DoD have renewed our commitment to the mixed fleet concept. That is, for heavy-lift launch requirements, we plan to develop and produce the Titan IV. For smaller payloads, we will modify the deactivated Titan II ICBMs. Both of these programs are underway. As I noted above, the recovery strategy also calls for increased Titan IV production and development/production of a medium launch vehicle (MLV).

This DoD/NASA coordinated plan includes making some payloads dual-compatible between the Shuttle and ELV; off-loading some Shuttle missions to ELVs (e.g., Milstar), and expanding to a dual-coast launch capability. We also hope that the MLV competition for launching Navstar Global Positioning System satellites will help stimulate commercial space launch capability. These efforts will significantly improve our nation's space launch capability and also provide for long term stability.

For the next several years, Shuttle and ELV manifesting issues will be of critical importance. Major efforts are underway within DoD and between DoD and NASA to address these issues. The methods by which the Shuttle manifests are produced and problems resolved are well established and understood.

Shuttle manifesting, coordination, and prioritization issues are managed at the lowest possible organization levels. The Shuttle and ELV program offices located at the Air Force Systems Command Space Division in Los Angeles are responsible for DoD mission model preparation. A large group of dedicated experts work closely with the NASA staff on a routine basis to produce the complicated manifests that must take into account a myriad of mission requirements and launch constraints. Mission model development is complicated and must take into account such requirements as satellite constellation health; launch windows; hardware availability (spacecraft, launch vehicle, upper stages); launch pad/spacecraft processing times and constraints, and the capacity for handling secure missions as well as on-orbit checkout. Biannually, DoD mission requirements are reviewed in Washington DC. The requirements are then transmitted to NASA. NASA personnel participate in the entire process. While DoD can exercise national security priority over civil and commercial missions, DoD has never had to exercise that priority. Every possible effort is made to coordinate our mission requirements with NASA so that the resulting manifests reflect true national priorities.

To summarize, Mr Chairman: We must currently rely on our near-term launch platforms (Shuttle and Titan 34D) to place our most critical payloads into orbit. DoD and NASA are making every possible effort to produce a Shuttle manifest that reflects national priorities. Your support will help ensure that we are on the right track to recovery from the Challenger accident and maintain a healthy space national space program.

Mr Chairman, this concludes my remarks.

Mr. NELSON. OK.

Mr. Gillam.

STATEMENT OF ISAAC T. GILLAM IV, ASSISTANT ADMINISTRATOR, OFFICE OF COMMERCIAL PROGRAMS, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Mr. GILLAM. Thank you, Mr. Chairman.

Let me make it unanimous on the part of the panel: it is a pleasure to be here this afternoon to discuss this significant problem with the subcommittee.

I would like to begin by entering my statement into the record, and just talking very briefly. I would like to make three major points.

The first major point that I would like to make is: I would like to make a distinction between what we in NASA call primary payloads and secondary payloads. In that regard, Admiral Truly has been discussing the manifesting of primary payloads. These are our commercial revenue-producing activities. In the secondary payload category we have our commercial research ventures, which are joint endeavor agreements.

Once Admiral Truly has worked out a manifest for the primary missions, then we will begin to schedule those missions, and there is developing a backlog of those types of missions, as well.

With regard to the Palapa B-2 and the Delta, it is my understanding that in the vicinity of June 25 or 26, the United States Government made an offer to Indonesia that United States Government decision to offer the Delta launch to Indonesia was based on its position on the launch schedule at the time of the *Challenger* accident and the urgency of its need.

My understanding is that that was made to the Foreign Minister of Indonesia by Secretary Shultz on his visit to Indonesia.

Mr. NELSON. Has a price been communicated to them?

Mr. GILLAM. No, sir.

Mr. NELSON. Is the price a matter of negotiation?

Mr. GILLAM. No, sir.

Mr. NELSON. Is this a critical need for Indonesia?

Mr. GILLAM. Yes, sir. That is my understanding.

Mr. NELSON. Then if it is a critical need, why are they concerned about negotiating a price?

Mr. GILLAM. I have no knowledge that they might be concerned about negotiating a price. We are going to offer them terms and conditions, and the way those are settled right now is that they will be offered the launch on an actual cost basis, and we have an estimated cost that we will provide.

Mr. NELSON. And when might——

Mr. GILLAM. We have not transmitted any terms and conditions to the Indonesians as yet, sir.

Mr. NELSON. OK. Is it possible that they are negotiating with Ariane, as well?

Mr. GILLAM. Very possible, sir, but I have no knowledge of it.

Mr. NELSON. Who would, besides the Indonesians and the French?

Mr. GILLAM. I don't have the slightest idea.

Mr. **Nelson**. You had not heard anything in NASA?

Mr. **Gillam**. No, sir. I have not heard any rumors to that effect.

Mr. **Nelson**. What does the Secretary of State say? He does not communicate daily with you?

Mr. **Gillam**. Not on a regular basis. [Laughter.]

Mr. **Nelson**. All right. Please go on.

Mr. **Gillam**. An internal arrangement had to be worked, which is associated with the status of the Delta hardware that is shown on the last page of my testimony.

That internal arrangement was that in order to have available hardware to make the date requested or required by the Indonesians, which was the first quarter of 1987, we had to work an arrangement with the DOD to use one of the three already built Delta vehicles that was scheduled for a DOD mission in accordance with the last page of that hardware status, and that Indonesia would pay the cost of replacing that hardware to the DOD on a schedule that would be in time to meet the DOD schedule.

Just for your information, since there has been such a substantive amount of questions and speculations about the status of Delta hardware, that chart includes the status of the total Delta hardware as it exists—the residual flight hardware as it exists today.

The plan is to launch the Indonesian payload in approximately March 1987 and then proceed with the DOD launch on its previous schedule.

That is about the extent, other than what is contained in the written statement of the comments we have to make on Indonesia. However, three of the Delta sets of hardware are in a partial state of completion; Delta vehicles 182, 183, and 184.

If you assume the Delta 182 is going to replace the hardware loaned to us by the DOD, we have vehicles 183 and 184, which can be used for a series of options. However, since we received the instructions related to the Indonesian offer, the Department of Defense has asked for two additional vehicles.

It is possible for the two additional vehicles requested by the DOD to be vehicles 183 and 184, or to come from the subsequent sets of long-lead materials that we have available. A decision has not been reached.

The one offer has been made to Indonesia. Contrary to reports otherwise, we have made no other offers. We are holding options open that are available to us, such as incorporating a couple of other very necessary commercial launches in, but we have made no decisions to do so. The option also remains to use vehicle 182 for replacement to the DOD for Indonesia; 183 and 184 for the requested additional DOD launches.

That is the status of the Indonesia situation, sir.

I would be pleased to answer your questions.

[The prepared statement of Mr. Gillam follows:]

National Aeronautics and
Space Administration

Hold for Release Until
Presented by Witness

July 17, 1986

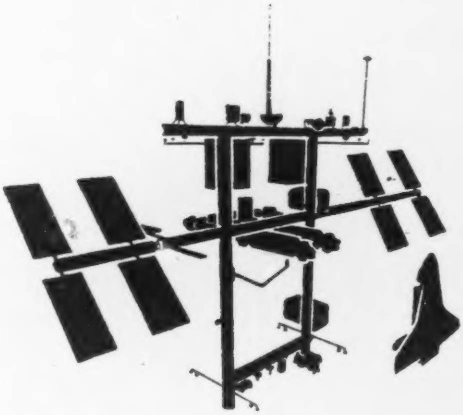
Subcommittee on Space Science and Applications

Committee on Science and Technology

House of Representatives

Statement by:

Isaac T. Gillam IV
Assistant Administrator
for Commercial Programs



99th Congress

Hold for Release until
presented by witness on
July 17, 1986

Statement of

Isaac T. Gillam IV
Assistant Administrator
Office of Commercial Programs
National Aeronautics and Space Administration

before the

Subcommittee on Space Science and Applications
Committee on Science and Technology
House of Representatives

Mr. Chairman and Distinguished Members of the Subcommittee:

I appreciate the opportunity to appear before the subcommittee today to discuss commercial development payloads manifesting. Per your request, I will also address the status of the Delta flight hardware and NASA's plans for the potential Indonesia Palapa satellite launch.

First, let me distinguish for the record the difference between fully reimbursable payloads (such as communications satellites), which usually fly as primary payloads, and commercial development payloads (such as materials processing experiments), which fly predominantly as secondary payloads in the Shuttle middeck or on carriers in the cargo bay. The former type of payload can usually be launched on expendable launch vehicles and it is that type of payload which the Administration is now considering moving from the Shuttle to expendable launch vehicles. Commercial development payloads that are man-tended or Shuttle-dependent are flown under a variety of arrangements designed to facilitate new commercial development activities in space.

Middeck space on the Shuttle is at a premium and many types of users are queued to use that space. Carriers in the payload bay of the Shuttle cannot be manifested as frequently as users would like due to the requirements for primary payloads. Thus when the Shuttle does begin to fly again, manifesting for secondary payloads will be a challenge. We fully expect to maintain an appropriate share of available space for commercial development payloads. In practice, before the Challenger accident, this share was about one-third of the available capacity. This Administration is committed to encouraging private sector investment and involvement in commercial space activities through an active program of commercial experimentation. We expect that such payloads will continue their fair share of Shuttle capacity when the Shuttle flight program resumes.

Now, let me turn to the status of Delta vehicle hardware. Table I summarizes the state of completion of vehicles and availability of long lead materials for Delta vehicles 179 through 192.

In June, the United States decided to offer Indonesia an early 1987 launch of its Palapa B2P communications satellite on a Delta vehicle, taking into account Indonesia's position on the pre-Challenger accident schedule and the urgency of its national telecommunications needs. The NASA Administrator directed us to develop a plan proposing such a launch to the Indonesians and to follow through with a launch should the Indonesians accept.

On June 26, 1986, Secretary of State Shultz officially informed the Indonesian Foreign Minister of the offer. The vehicle which could be used is currently assigned to a DOD mission. We have reached an agreement with DOD for use of this vehicle and will meet DOD's launch requirements with another vehicle. No new appropriation of government funding would be required for this replacement vehicle and, in fact, DOD will receive a credit for shared launch costs with the Indonesians.

The Indonesians have not yet accepted the U.S. Government's offer pending negotiation of a letter contract which would contain the price Indonesia would have to pay for the Delta launch vehicle. NASA is preparing its terms and conditions for transmittal to the Indonesians.

DOD has recently requested two additional launches. Meeting that request, plus the Indonesia launch, could thus include completion of three partially built Delta vehicles (182-184).

I will be happy to respond to any questions you may have.

Table I

Status of Delta Hardware

Vehicle	Mission	Production Status	
		1st Stage	2nd Stage
179	NOAA	Completed	Completed
180	DOD	Completed	Completed
* 181	Tentative Indonesia	Completed	Completed
182	DOD	Incomplete	Completed
183	Unassigned	Incomplete	Incomplete
184	Unassigned	Incomplete	Incomplete
185-192	Unassigned	(Long Lead Materials Only)	

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* This vehicle is currently assigned to DOD but tentatively planned for the Indonesian launch.

Mr. NELSON. General, your first Titan IV is 1988?

General RANDOLPH. Yes, sir. Right now, it is October 1988.

Mr. NELSON. And your Titan II's are refurbished and launched over what period of time?

General RANDOLPH. Let's see, we will begin launching Titan II's in about a year, and we have 13 of those approved right now, and we will probably launch them on a 2-or-3-a-year basis.

Mr. NELSON. Starting in what year?

General RANDOLPH. Starting next year.

Mr. NELSON. All right. And then your six remaining 34-D's?

General RANDOLPH. We will be launching those in 1987 and 1988, to complete the launch of those six remaining.

Mr. NELSON. OK. So, after 1988, you have got the CELV, now called the Titan IV.

General RANDOLPH. Yes.

Mr. NELSON. Presumably by 1989 you will have an MLV, so you have got a second horse in the stable.

General RANDOLPH. That's right. Yes, sir.

Mr. NELSON. And then, depending on what NASA does with the Deltas, we have that force; we have the shuttle.

OK. Now, having assured access to space until we get some radical new vehicle, which is well into the next century, what else do we need for assured access to space? What about a heavy—lift vehicle?

General RANDOLPH. There is a study that we did with NASA, which is called the space transportation architecture study, which we have just completed, and has not yet been released. So I really do not want to go into specific details, but what that study does recommend to the administration, and presumably eventually to the Congress, is that we begin looking at the necessary technology to do two things: one is to lower the cost per pound of getting payloads into orbit, and another to address the very issue that you just raised: what about a heavy-lift launch vehicle in the future?

Mr. NELSON. Well, the time of development on such a thing would be, what, 6 or 7 years before you could have it operational?

General RANDOLPH. Oh, yes. Yes.

Mr. NELSON. Minimum?

General RANDOLPH. Oh, yes; easily. Easily 6 or 7 years.

Mr. NELSON. So, if you started today, you would still be middle 1990's before you would have it ready?

General RANDOLPH. Yes, sir.

Let me just give you my personal view on that. I would start it today, because one of the things that we really do need to work on is the technology. We really do need to take advantage of the automation capability that exists today and which we have not yet applied in trying to figure out how do we reduce the number of people on the ground necessary to accomplish launches.

We do need to take a look at how do we improve the energy available so that we can launch more efficiently. We do need to take a look at the improvements in materials and try to determine how that might apply to better launch vehicles.

So, I do really believe that the first order of business is to spend some time looking at applying technologies that have surfaced to the launch problem.

I do not know about the shuttle, and I am not an expert on the shuttle, so I am not going to discuss that, but I will tell you the Titan is a 1960's booster, and it uses 1960's technology. We have improved it over the years, but, in the final analysis, the first Titan launch that I participated in, I was a captain, and that is an Air Force captain, not a Navy captain, so that has been one heck of a long time ago since I have been a captain, and it is basically the same vehicle that has been upgraded.

So, I really believe that we need—the country needs—to spend some time determining the best approach to doing that before we step off and start working on the problem. And, in fact, in the final analysis, I think we save time and money by doing it that way.

Mr. NELSON. OK. Now, do we, with what we just discussed, and if we take that time that you are talking about to make sure we know what we want to do about a heavy lifter, do we have the capability, with what we just discussed, to work off the backlog and then have the assured access to space that we need by the mid-1990's?

Gentlemen?

General RANDOLPH. From the DOD point of view, my answer is yes. By having the expendable launch vehicles, by having the shuttle, and having that mixed fleet available, and having a reasonably robust fleet, if you will, of different types of vehicles to handle our payloads, my answer is that by the mid-1990's we will certainly have that assured access to space that we are looking for and can accommodate the problems. Obviously, anytime you are dealing with machinery, you are going to have problems of some kind, but by having the described recovery plan, we believe we are in a position to accommodate the problems and, therefore, have the assured access to space.

Mr. NELSON. To date, the Delta is about 26 years old, isn't it? So, by the mid-1990's, it would be upward of 35 years old. Does that suggest to us, in view of your comments just a second ago about you were launching Titans when you were an Air Force captain, that we should start to develop a new technology ELV other than the heavy-lift vehicle which we have discussed?

General RANDOLPH. I think that the plan should be that we ought to take a look at the proper approach, and that is why I am saying we ought to spend some time looking at it. I will give you my concept.

My concept is that with the right technology, and our understanding of the problem today, it just seems to me that there should be an opportunity to develop a modular type of a launch vehicle, that is, a vehicle that can handle the various levels of payloads by putting together different modules. So, you would not develop a heavy lifter over here, and then over here develop a medium-launch vehicle. But, in fact, you could work this in a modular sense.

Now, you know, your immediate response to me, and one that we are thinking about, is, aha, but if you start depending on a single string of technology and something happens, then you shut yourself down completely. And we are thinking about that.

But the point that I was raising earlier is, we ought to give ourselves time to decide whether that is a good idea or not and what technologies we would apply to solving that problem.

Mr. NELSON. Is the 34-D going to launch again next year?

General RANDOLPH. Yes, sir. We hope to be able to launch early next year, and the reason I want to underline "hope" is because we have got inspection procedures, we have got testing procedures, but, as Admiral Truly has pointed out, clearly, if a hiccup happens between now and then, that will set us back again.

Mr. NELSON. And is that delay occasioned—is the length of that delay—because of the damage to the launch pad?

General RANDOLPH. No, sir, it is not. It is because of getting the launch vehicle, itself, ready.

What we want to do is: As you recall, we had an onbonding problem that we want to be sure that we can properly inspect each one of those segments, and that we are absolutely certain that we have got a quality segment before we are ready to go shoot.

Mr. NELSON. OK.

I have got to run back to vote. I will run over there and vote, and then we can go on and wrap this up pretty quick. We will stand in recess.

[Recess.]

Mr. NELSON. OK. We will resume.

General, if, with the offload of these payloads from what originally the *Challenger* had been anticipated to be the shuttle cargo bay, who now ELV launches, how does that change, then, your future payments to NASA?

General RANDOLPH. The payment process, if you recall, sir, is that we ask for a launch, a slot, if you will, and then we pay for that slot a year in advance; so we go—and then, of course, when we go through the manifest, we predict where we will need the slots and then NASA does the planning accordingly.

So, we only pay for those slots that we actually use because we are simply a customer of the shuttle, so our payments will be adjusted according to the slots that we actually use as far as the flights.

Sir, may I also make one correction. I made a statement earlier on the Titan II. You asked me the Titan II date, and I said 1987. It is early 1988. So I am just making a correction.

Mr. NELSON. OK.

Now, Admiral Truly, you, Mr. Gillam, what percent of your payload budget or—no, I guess what we ought to say, is total budget—what percent of the budget does their Air Force payments to you represent, and how does that change in your calculations over the time?

Admiral TRULY. Mr. Chairman, I would, with your permission, like to provide that answer for the record.

Mr. NELSON. OK.

[Material to be supplied follows:]

The Office of Space Flight's Shuttle Operations budget planning combines expected reimbursable revenues for Shuttle standard services with NASA direct appropriations.

DOD payments for Shuttle flights in the FY 1987 Congressional Budget make up approximately ⅓ of the total Shuttle Operations budget planning. The following table displays the percentages by fiscal year:

	1986	1987	1988	1989	1990	1991
Shuttle operations direct budget request	1,725	1,525	1,317	1,391	1,427	1,517
Expected standard services reimbursements	320	704	1,039	1,123	1,152	1,224
Department of Defense	223	531	787	775	983	923
Total shuttle operations budget planning	2,045	2,229	2,356	2,514	2,579	2,741
Percent DOD reimbursements of total	10.9	23.8	33.4	30.8	38.1	33.7

Mr. Nelson. Let's talk about shuttle Centaur. NASA has spent a whole bunch of dollars getting ready Centaur to fly in the shuttle. Now, it is not going to fly in the shuttle; it is going to fly on top of a Titan IV. There are certain monies that have been expended in the development of this Titan Centaur that are now going to accrue to the benefit of the Air Force. Indeed, the Air Force has already spent some money, itself.

Is there going to be any kind of reimbursement by the Air Force back to NASA for the monies that NASA has expended that now accrues to the Air Force benefit?

General Randolph. Sir, I really cannot address that, because, as you recall, we just learned that the Centaur would not be flying on the shuttle, and, as a I testified a little earlier, we are still in the process of trying to determine what all the impacts are and what that really does mean to us.

So, except for that Milstar decision, we have really made no decisions at all.

Mr. Nelson. OK. Now, as we look to the future of assured access, may I take this opportunity to give you some of the thinking of our committee, and that is we realize that we made a mistake on relying on a single vehicle; that that was our mentality; that we were going to have the space transportation system, and everything was going to go on it. And so, as we recoup from this national tragedy, we realize we have to have more horses in the stable.

It is the concern of this committee that we not rely just on old horses, but that we continue to prepare for new, young, vigorous horses that are going to be capable of the task that we have for the next 14, 15, 16 years, until some major new kind of access to space is available.

At the same time, this committee is very interested in seeing our manned access be available with the insurance policy that we need, which is that we have enough orbiters, so that if we had any kind of accident, that we would still have a sufficient number with which we could still do the things that we have to do for manned access to space, and I think we would be very interested, also, in seeing our capability in the midnineties of being able to put up heavy payloads.

So, that is pretty much our thinking at this point. I think you said we had to study this heavy-lift vehicle, and we have got to see what kind of technologies; and you used the word "modular" concept, and so forth. I think that is good, but I think now is about the time that we ought to start making some decisions on this—certainly on the rest of this stuff, we have got to make the decisions now.

Yes, sir, Mr. Gillam.

Mr. GILLAM. Mr. Chairman, I would like to say a few words about reliance on old horses. I recall the first Delta launch that occurred on about April 13, Friday the 13th, 1960. That was the first and last Delta launch on a Friday, the 13th, because it failed.

I would like to say that the Delta, that failed recently, bore no resemblance to the Delta that was first launched in 1960. The first stage structure has been changed. The electronics have been changed. The first stage propulsion system and second stage propulsion system, the second stage manufacturing processes, the guidance system has been totally changed.

And while it bears the name Delta and resembles an old horse—while it is by no means a modern design; it has been stuck together, piece by piece, part by part, over the years—it is not the same launch vehicle that it was 5 years ago, much less 25 years ago.

Mr. NELSON. Thank you very much.

All right. Let me do some cleanup here on a couple of things.

How can we improve, Admiral, the manifesting of payloads on the shuttle in the future, so that we don't have any wasted space, or we don't have any empty space? What are you doing, which I know you are doing a lot, to assure that that is not going to be the case in the future?

Admiral TRULY. Well, I think that we are in a position now that we are not going to have to worry about, well, I should not say we are not going to have to worry about—we are going to have to work hard—but I believe that side of the problem will be the easy side, and that is making sure that we use every bit of the lift capability of the shuttle, because one of the things, as an example, that we deal with is down-weight, trans-Atlantic abort down-weighted Dakar, and so we found ourselves with situations with some of these most crucial payloads that they are very heavy, and generally the data that I showed you earlier is on anequivalent payload base; that is the way you measure it.

You can never use the very last pound, but we are not going to launch a shuttle for the next several years that has, for example, enough room and payload weight capability in it where we could have put one of the satellites that we have in the stable.

We are going to use every bit of that capability. During our downtime, I am going to take a good look at our manifesting procedures.

I think a lot of improvements can be made. You may recall that the Rogers' Commission made a specific recommendation that we take a look at our discipline on late changes because of the pressures that are caused in the planning process, and I have that in work, but using the payload capacity of the shuttle from the time that we start flying again into the midnineties is not going to be a hard thing to do.

Mr. NELSON. All right. Now, how about the mid-deck, utilizing all the space there?

Admiral TRULY. As Mr. Gillam mentioned earlier, I think again that is also going to be a crucial and tough problem to solve, and again it is going to come back to landing weight and not so much volumes.

Let me give you a couple of examples, or an example. We are discussing many ways to reduce the basic weight so that we can meet the down-weight requirements for the heavy payloads as we look at planetary alternatives as a result of the shuttle Centaur, even so much as reducing crew size, reducing the amount of cryogenics—in other words, length of mission—in order to look at alternatives to Centaur, so that we get our precious planetary missions, Galileo, Ulysses, Magellan, et cetera, flown.

By that very nature, that is going to restrict us from taking a lot of heavy mid-deck experiments on those flights. There is just no way around it. So once we get through this primary payload manifesting problem, we are going to have to look at the secondary manifesting problem, some of which is in the payload bay, but a lot of it is in the mid-deck.

We are going to have a backlog there, also.

Mr. NELSON. I noticed on 61-C that there were a bunch of empty locker space. Now, we might have had a center of gravity problem, but that is one reason that I raised this issue. I don't want you to spend your time going and looking in the past; I want you to focus on the future. But I am sure that there has been a problem in the past that not all that mid-deck space was effectively used, and that, you are going to have to attend to and have your people tend to in the future.

Admiral TRULY. I am not—as you mentioned—I am not familiar with that specific flight. That does surprise me, from my experience. On the STS-2 and STS-8, every nook and cranny was filled with something that was a useful use of our time. As a matter of fact, on the STS-2 the major constraint was—with only two people onboard—was our time; however, we did take a lot of things up.

I am not familiar with this 61-C, and I appreciate very much your not asking me to go back and check on that, because I do have plenty of things to do for the future.

Mr. NELSON. I understand that, and I am sensitive to that. I will find that out on my own so you won't have to. I know there was plenty of empty space. The question I don't know is: was it legitimately a center of gravity problem, and I will find that out. Don't worry about it.

Let's talk about the west coast.

General, one plan being proffered right now is to put in a caretaker status, Vandenberg, until such time as it is efficient to go ahead and start launching from the west coast.

So what is going to be the effect on the DOD shuttle priorities, payload priorities, if such a caretaker status is put out there on the West Coast?

General RANDOLPH. The thing that we are working right now with regard to the West Coast is: how best to begin launching the shuttle from the West Coast, in view of the fact that there are three orbiters. We are taking into account the current schedule, which was just revised, as you will recall.

We are taking a look at our needs—in terms of being able to—of the things that are demanding the launch from the West Coast, and we are taking a look at how best to use the three orbiters efficiently.

And all of those pieces are being worked on; as a matter of fact, as we speak. We expect to make a decision on that, in fact, within the next few days, and, again, of course, we will report to the committee on our decision as to how we are going to work that problem.

Mr. **Nelson**. Right now, would that decision also affect—you are going to make a decision; how many you are going to put on ELVs, where they are going to be launched, et cetera, et cetera.

General **Randolph**. Yes, sir.

Mr. **Nelson**. Will some of that be classified?

General **Randolph**. The specific payloads will be classified, but the concept, of course, will not be.

Mr. **Nelson**. The concept of the launches will not.

General **Randolph**. No, sir. No, sir.

Mr. **Nelson**. All right. How many, then, of the current payloads would require a West Coast launch?

I gave you the opportunity to say that was classified.

General **Randolph**. Yes. I will have to provide that to you, sir, as opposed to this open session.

Mr. **Nelson**. That is what I thought you would say.

Okay. We need that information.

General **Randolph**. Yes, sir. And we will be sure to provide that to you.

[The material to be supplied follows:]

PAYLOADS REQUIRING A WEST COAST LAUNCH

Question

Mr. **Nelson**. All right. How many, then, of the current payloads would require a West Coast launch? I gave you the opportunity to say that was classified.

General **Randolph**. Yes, I will have to provide that to you, sir, as opposed to this open session.

Mr. **Nelson**. That is what I thought you would say. Okay. We need that information.

General **Randolph**. Yes, sir. And we will be sure to provide that to you.

Answer. Prior to the Shuttle accident, the DOD plans for Shuttle missions at Vandenberg AFB were as follows (Shuttle Bay Equivalents): FY 86 [deleted]; FY 87 [deleted]; FY 88 [deleted]; FY 89 [deleted]; FY 90 [deleted]; FY 91 [deleted].

Mr. **Nelson**. If the West Coast launch site does not become operational within the near term, how will DOD be billed for the East Coast launches?

General **Randolph**. We have not yet worked that billing structure. In fact, we have, as part of that discussion, as to exactly when we will start launching from the West Coast, we have to take into account updating our memorandum of agreement with NASA on how we actually do the payments. So that is part of the discussion that is ongoing right now.

Mr. **Nelson**. Admiral Truly, how many launches for the space station assembly do we anticipate after 1992?

Admiral **Truly**. I would like to provide the details of that for you for the record, but, if I recall, in the first year of their assembly, the station has requested eight flights.

You make an important point, though, or allude to an important point: There is a significant demand that is represented by the permanently manned space station, and the information I have here is that in 1993 the request is eight equivalent payload bays; 1994, 10; and 1995, 6.

[The information follows:]

Starting in January 1993, we anticipate that approximately 32 shuttle launches will be required during the Space Station assembly process. Of these, 17 launches are needed for assembly of the manned base, including the international elements, and three to launch the platforms (two U.S. platforms and one ESA platform). At the ninth assembly launch, when the Station will be permanently manned, but prior to complete assembly of the Station, twelve additional launches will be required, interspersed among the remaining assembly launches. These twelve launches are required to deliver user payloads and for logistics purposes which will support the Station, crew, and those experiments which will be possible prior to full assembly.

After the assembly is completed in 1996, the number of logistics launches per year remains to be determined.

Mr. NELSON. All related to shuttle; I mean——

Admiral TRULY. To station.

Mr. NELSON [continuing]. All related to station.

Admiral TRULY. That's right.

Mr. NELSON. And that is more than just assembly. That's supply and——

Admiral TRULY. Toward the end of that, that gets into supply and operation.

Mr. NELSON. OK. Now, are there alternatives being proposed right now at JSC?

Admiral TRULY. It is my understanding, although I have not personally been involved, that there has been some initial study work on a heavy-lift capability in the mid-nineties for station, but I am not personally familiar with it.

Mr. NELSON. You mentioned to us, Admiral, that if you had an emergency landing, what was your weight restriction, and so forth.

Admiral TRULY. That's right.

Mr. NELSON. So, when you supply that information to us, please give us that.

[The information follows:]

The current Orbiter landing weight limits are 211,000 pounds for normal end of mission (NEOM) landings, and 240,000 pounds for transatlantic (TAL) abort once-around (AOA) and return-to-launch site (RTLS) abort landings.

A structural loads analysis is being performed with heavier landing weights. These are 214,000 pounds for NEOM; 248,000 pounds for TAL/ADA aborts, and 256,000 pounds for RTLS aborts. This analysis is scheduled to be completed by February 1988.

Admiral TRULY. OK.

Mr. NELSON. In other words, what are your weight restrictions vis-a-vis the maximum weight that you can have, given the facts——

Admiral TRULY. I will be pleased to.

Mr. NELSON [continuing]. In that scenario.

Admiral TRULY. I will be pleased to, and that is under review. As a matter of fact, we have, also, a loads analysis going on so that we can certify the vehicle for a somewhat heavier downweight, which directly helps our ability to manifest.

Mr. NELSON. All right. Now, which one of you wants to talk about this Indonesian satellite?

Mr. **Gillam**. That depends on the question, Mr. Chairman. [Laughter.]

Mr. **Nelson**. All right. You want to go through the remaining Delta hardware that you have.

Mr. **Gillam**. Yes, sir, Mr. Chairman. We have three completely assembled Delta vehicles, 179, 180, and 181. We have three partially assembled vehicles; that is, the stages are not assembled as stages. These are vehicles 182, 183, and 184.

We have eight sets of long-lead materials, which are materials to be used to construct the components and parts of the vehicles, including engines. There are eight complete sets of the long-lead materials necessary to initiate that construction, and that is the total inventory of residual flight hardware that we have available to the Delta, in addition to the flight spares.

We have certain elements of hardware, like one spare first stage engine, one spare second stage engine, and one set of caster motors, those kinds of things, that are not included in that inventory.

Mr. **Nelson**. Can you speak for Dr. Fletcher, as to whether or not he wishes to utilize this existing hardware for other shuttle commercial customers?

Mr. **Gillam**. No, sir, not in the sense that NASA has access to only three sets of that hardware. DOD has first call on the remainder of the hardware. DOD has released to NASA 182, 183, and 184.

Mr. **Nelson**. Unless you started shifting some of those to commercial customers. Is that being discussed?

Mr. **Gillam**. No, sir, it is not.

Mr. **Nelson**. You are expecting those three sets of Deltas to go to SDI?

Mr. **Gillam**. It is possible. The key option that we are considering is that 182 will go to the DOD as a replacement vehicle for 181, and that 183 and 184 can also go to the DOD. If 183 and 184 do not go to the DOD, and the DOD would use the first two sets of the long-lead hardware for the two missions that they have requested, then the other two vehicles could be available as an option to commercial customers.

Mr. **Nelson**. OK. Now, if that were the case, the scenario that you just painted, how would that affect the development of a commercial domestic ELV industry?

Mr. **Gillam**. Our concept, originally, was that, since the last two of those vehicles cannot be produced before 1988 and readied for flight, that it would give us the opportunity to work arrangements with the private sector domestic ELV provider. They would meet some specified requirements on the part of the Government and possibly work as a partner in the use of 183 and 184 in the eventuality that those two vehicles would be used for commercial payloads. But that option has not been exercised; it just remains available as one of the many options to alleviate current requirements.

The two principal options that we are looking for is that 182 is a replacement for SDI and 183 and 184 go to SDI for their two additional missions, or, 182 is a replacement for the Indonesian vehicle to SDI, 183 and 184 are used for commercial vehicles, and SDI gets 185 and 186.

Those are the primary options that we have looked at. We have not made a decision on either one.

Mr. NELSON. Is it true that NASA entered into an agreement with the SDI office about Delta hardware that was controlled by the TCI agreement?

Mr. GILLAM. At the time of entering into the agreement with the DOD, that hardware was not controlled by the agreement because we were between extensions of the contract. If you will recall, the original TCI contract called for all the residual hardware to go to TCI under the basic contract. The basic contract expired in October 1984 and has been extended through May 30, 1986, in incremental periods of time.

In November 1985, NASA entered into an arrangement with the DOD for that residual hardware because of a priority exercise by the DOD, and that agreement is still in effect and will remain in effect, to our knowledge, for 2 years.

Mr. NELSON. So, you did not modify the TCI agreement?

Mr. GILLAM. Yes, we did.

Mr. NELSON. You did?

Mr. GILLAM. We have modified it in amendment No. 5 to the contract. That was an amendment that we signed in, I believe, December 1985.

Mr. NELSON. So, you modified it to exempt this hardware.

Mr. GILLAM. Correct. Yes, sir.

Mr. NELSON. And in the fact that SDI said they needed the hardware, then, in effect, TCI did not have anything to sell, did they?

Mr. GILLAM. They still had their agreement with us, with the authorization to initiate production and to market the Delta system. They did not have access to the hardware that would have allowed them to short circuit the process. By short circuit the process, I mean shorten production leadtime.

Mr. NELSON. Well, let's see. I am just a little country boy from Florida, but I am trying to understand this logic. Now, SDI has said that it is willing to release this hardware now, because NASA has said it wants it for Indonesia, but it would not release it before for TCI.

Mr. GILLAM. I did not say that, sir. I don't know that TCI has requested SDI to release the hardware. I have no personal knowledge of that.

Mr. NELSON. But you modified the agreement, did you not?

Mr. GILLAM. To conform to the agreement that we had existing, yes, sir.

Mr. NELSON. So that it would go to SDI.

Mr. GILLAM. Yes, sir.

Mr. NELSON. So, in effect, that did not release that hardware for TCI.

Mr. GILLAM. That is correct, sir.

Mr. NELSON. OK. You see the inconsistency.

Mr. GILLAM. But SDI can say, we don't need this hardware, and you can have it. SDI can release the hardware from the obligation—the joint obligation between NASA and SDI to TCI.

Mr. NELSON. SDI said previously, we are going to put a hold on this hardware.

Mr. GILLAM. Hardware for our needs.

Mr. NELSON. For their needs.

Mr. GILLAM. And they can release that hold at any time.

Mr. NELSON. OK. But they didn't, so TCI did not have anything to sell.

Mr. GILLAM. Yes, sir.

Mr. NELSON. Now, here comes Secretary of State, Mr. Shultz, and now SDI suddenly releases its hardware.

Mr. GILLAM. Releases three sets. They retain access or first option on the other hardware with the exception of the three sets. They did not release the total amount of hardware. They released 182, 183, and 184. At the same time, they ordered two more missions.

Mr. NELSON. We are not talking the same language here.

I want you to explain it to me. Here, SDI has a hold on this hardware.

Mr. GILLAM. Yes, sir.

Mr. NELSON. For SDI flights.

Mr. GILLAM. Yes, sir.

Mr. NELSON. OK. Now, they don't modify that until you come over here and say, you have got to have this to launch an Indonesian satellite. Now, are you playing by the same ground rules from here to here?

Mr. GILLAM. I am afraid I cannot answer that question, sir. I don't know, is the answer.

Mr. NELSON. There is a question in this committee, I can tell you that, about whether or not NASA is being consistent here, or whether or not the Government is being consistent with regard to its policy.

Mr. GILLAM. Well, sir, I would like to say in that regard, NASA, as a Government agency, has to be receptive to the exercise of certain governmental priorities.

Mr. NELSON. I understand that. I understand that.

Mr. GILLAM. And the request on the hardware initially was a governmental priority. This was Government-owned hardware. When that priority is exercised, I am not sure NASA has an option.

Mr. NELSON. I understand that, also, as long as all the policymakers are making the decision.

Mr. GILLAM. I don't think they were involved in this one.

Mr. NELSON. That's right. That's exactly right.

Mr. Walker, do you have any questions?

Mr. WALKER. Thank you, Mr. Chairman.

I am a little confused by the discussion I just heard. I am not certain I followed it, either. I will look back in the record, I guess, when we get it, to try to figure out what went on. But I guess my concern is—maybe it is something that has been covered, and I am sorry for not being here—but, what are we doing to aggressively bring the private marketeers into the marketplace right now to take care of the backlog of missions that we know are there? I mean, what is our plan for an aggressive effort to get private people involved in building rockets that can take care of this backlog? Do we have a program?

Mr. GILLAM. We are in the process of developing such a plan in the commercial space working group of the Economic Policy Council.

Mr. WALKER. And when do you think that will be ready?

Mr. **GILLAM**. My understanding is, within the next few weeks, sir.

Mr. **WALKER**. Meaning what? By the 1st of September?

Mr. **GILLAM**. No, sir.

Mr. **WALKER**. By the 1st of October?

Mr. **GILLAM**. No, sir. By the 1st of August.

Mr. **WALKER**. By the 1st of August?

Mr. **GILLAM**. Yes, sir.

Mr. **WALKER**. OK. So, in other words, by the beginning of next month, we should have a plan for involving the private marketplace in expanding the production of vehicles so that we have the option available to us of reducing the backlog with ELV's.

Mr. **GILLAM**. That is my understanding of the situation, sir.

Mr. **WALKER**. And NASA is at that point, then, prepared to go into the marketplace and suggest to the private people that if you supply us with rockets, we have got missions for you.

Mr. **GILLAM**. I don't know how to answer the question, Congressman Walker. If that is what the plan calls for, yes, sir, it would be prepared to do that.

Mr. **WALKER**. OK. What other option would there be available? I mean, we know NASA has a backlog of missions that is developing. The military does. The military has solved part of their problem because they are in for a buy on CELV's. NASA has got a real problem, though, because you have now delayed the shuttle launches for another, at least 6 months beyond 1987. We are now into 1988. There is a question as to just how many missions will get off in 1988, so that you have got a real massive backlog. And so there is absolutely no doubt that NASA has missions that need to be flown, and, in fact, they had missions that need to be flown as early as this year or next year.

Now, what possibly could be another scenario where NASA would not be out aggressively seeking people to fly those missions?

Mr. **GILLAM**. Well, first, Congressman, NASA has to make the determination: Is there a possibility of ELV's or other alternatives that can fly the missions? With a substantial number of NASA's missions, such as Galileo, ISPM, it is not clear exactly how they can be done in view of the cancellation of Centaur; so we have to study that.

I think that there is one that I can think of off the top of my head—that is a better question for Dr. Edelson and the other payload people—maybe EUVE can fly on an ELV, but I don't know of a great deal of others that have that possibility, and we are studying that, sir.

Mr. **WALKER**. What about, though, a number of the missions that are basically commercial-side missions that would come through your shop? Aren't there a number of those that we have been looking at for shuttle flights that might be transferable? Communications satellite missions that would be transferable to ELV's?

Mr. **GILLAM**. The communications satellite missions come through Admiral Truly's shop.

Admiral **TRULY**. But the—in essence, the answer is yes; they are smaller satellites, and, in general, for example, on the Delta, that system would carry them.

Mr. **Walker**. OK. Do I understand from past testimony and what I am hearing here that NASA does now accept the need for a mixed fleet of ELV's in addition to the shuttle?

Admiral **Truly**. I believe since I have been on this job I have consistently testified that I support a mixed fleet; that the national situation of depending on a single launch vehicle is not a proper one, and I support a mixed fleet nationally.

Mr. **Walker**. Does NASA have any plans at present to purchase ELV's?

Mr. **Gillam**. Yes, sir. We have plans to purchase one.

Mr. **Walker**. And that is for the Indonesian mission.

Mr. **Gillam**. Yes, sir.

Mr. **Walker**. But you don't have any plans beyond that?

Mr. **Gillam**. We have options and no definite plans beyond that. We will be the purchaser if we work out the arrangements for the two that have been requested by the DOD.

Mr. **Walker**. This may not be an appropriate question for either of you at the table, although the figure just astounded me, and it tells what the problems are that we have got coming down the pike, and, Admiral Truly, you may be familiar with the figure.

I was told yesterday the storage of the space telescope alone will cost us $7 million a month, and that is an $84 million-a-year item just to store the space telescope.

Do you have any confirmation of those figures at all?

Admiral **Truly**. No, I don't. I would be pleased to get you that data, but that does not surprise me. One of the problems with these very sophisticated and high-technology systems is the fact that you just can't walk away from them, and so during this downtime there is going to be a large expense on the part of the DOD and in NASA with the sophisticated satellites, so that we can assure that when we have either the ELV capability or the shuttle capability to lift them, that they will be in prime shape.

[The information follows:]

To actively maintain the Hubble Space Telescope (HST) until launch will increase the development requirements by approximately seven million dollars per month. Operations, Maintenance and Refurbishment requirements will be reduced four million per month during this same period, for a net increased cost to the HST program of approximately three million per month during the launch delay.

The additional expenses incurred during the launch delay are attributed primarily to the cost of maintaining critically skilled contractor personnel. NASA has reviewed our prime contractors staffing levels on a position-by-position basis, and has determined that there is a minimum critical workforce of 400 prime contractor positions that must be maintained until HST is launched if we are going to gunarantee the health and safety of the spacecraft. Many of the HST systems and subsystems need constant care to avoid deterioration. Also, these positions are all needed during the critical period just prior to launch and during launch. These positions include 177 support system module positions, 56 system engineers, 60 optical and sustaining engineers, and 107 science positions (composed for principle investigators and their science teams). Many of the individuals included in these positions are highly trained specialists that have dedicated a significant portion of their careers to the HST. Their skills and unique knowledge of the HST would be difficult, if not impossible to replace.

The challenge facing NASA management is to minimize the attrition of this minimum critical workforce. In particular, the most valuable and highly-skilled individuals will have the greatest opportunities to work on other programs which may be in a more challlenging stage of development. Any such attrition will increase risk to the efficiency, success, and safety of the HST. NASA has not accounted for this risk by increasing minimum critical stafffing because the issue is not one of bodies. It is an issue of holding onto the specific individuals with the hands-on experience in building the HST.

Mr. **Walker**. But we could well, because the space telescope is probably one of those things that has to fly aboard a shuttle, I would guess——

Admiral **Truly**. That is correct.

Mr. **Walker** [continuing]. And it is likely to be at least 1988 or 1989, at the earliest, before you would fly a space telescope mission, and we could likely have a $200 million storage bill on the space telescope alone if those figures are anywhere close to correct.

Admiral **Truly**. Again, I can't vouch for the figures, but there will be a large national bill for these satellites for storage, as we wait for our capability to be available to launch them.

Mr. **Walker**. Thank you.

Mr. **Nelson**. Thank you, Mr. Walker.

I just want to say, in conclusion here, that we want to help the three of you all get about the business of fixing this problem, and let's get on with America's space program, so that we can get on back. The pictures represented in this room are of glories of the past and glories in the future, and there is a lot to be done.

We want to make sure that the agency that is charged with the responsibility of the civilian space program, in fact, has that capability of making its plans and executing on those plans, and that it does so in its appropriate separation-of-power roles in consultation with the Congress in the sharing of data and jointmaking of decisions back and forth.

And at a time like this, when there has been severe criticism of the agency, you have a lot of other cooks trying to get into the kitchen, and part of it must have been frustrating for your agency, Mr. Gillam, and Admiral Truly, and we recognize those frustrations, and this committee, where it sees those frustrations, we are going to call it as we see it. And if we see intrusions where we don't think there should be, we will call that, also.

I am happy, from our investigation, to note that there is a renewed, amicable, working relationship between NASA and the Air Force on a lot of the joint decisions that have to be made there, because of the joint use of facilities as well as hardware, and I commend you for that.

We thank you.

This is the beginning of a continuing series, and we will proceed—now, when is our next hearing? Our next hearing is Monday, at 1:30. It is at 1:30 in the afternoon on Monday. And who will our witnesses be then? Dr. Edelson—it's at 2 o'clock—and who else?

OK. We have got a whole host of people: Dr. Colladay, Dr. Donohue, Dr. Banks, and Mr. Hodge, along with Dr. Edelson. OK.

Admiral **Truly**. Thank you, Mr. Chairman.

Mr. **Gillam**. Thank you, Mr. Chairman.

Mr. **Nelson**. The meeting will stand adjourned.

[Whereupon, at 4:30 p.m., the subcommittee adjourned, to reconvene at 2 p.m., on Monday, July 21, 1986.]

PAYLOAD PRIORITIES

MONDAY, JULY 21, 1986

House of Representatives,
Committee on Science and Technology,
Subcommittee on Space Science and Applications,
Washington, DC.

The subcommittee met, pursuant to call, at 2 p.m., in room 2318, Rayburn House Office Building, Hon. Bill Nelson (chairman of the subcommittee) presiding.

Mr. Nelson. Good afternoon. Today we will continue our hearings on payload priorities.

Last Thursday we heard from NASA's Office of Space Flight and the Department of Defense on the overall outlook for shuttle availability over the next 6 years. Needless to say, the picture was not particularly encouraging.

After we have accounted for the national security needs, science, commercial, and other government payloads, then they are all going to be competing for a very limited number of flight opportunities and they will be very dependent on whether or not we are going to have a replacement orbiter. We are now all the more convinced that President Reagan needs to act immediately to address this critical situation of assured access to space.

So, today in our continuation of exploring this question of payload priorities and assured access to space, we are going to hear from representatives of the user communities who have planned to fly their payloads on the shuttle. I think that we will find that the shuttle has become a major transportation access to space component in these people's long-range plans.

We will hear from Dr. Tom Donahue of the National Academy of Sciences, its Space Science Board. Dr. Peter Banks, who chairs the Task Force on Scientific Uses of the Space Station, could not be with us today, so Mr. Dick Sade will represent him.

We will also hear from the manager who heads the major user offices in NASA; three, Dr. Edelson, Mr. Hodge, and Dr. Colladay.

So, we look forward to a most productive afternoon.

We will insert in the record a statement from our ranking member.

So, let's proceed.

Mr. Sade, we will start with you, in the order of the witness' list.

STATEMENTS OF RICHARD SADE, NASA, TASK FORCE ON SCIENTIFIC USES OF THE SPACE STATION; AND THOMAS M. DONAHUE, CHAIRMAN, DEPARTMENT OF ATMOSPHERIC AND OCEANIC SCIENCES, UNIVERSITY OF MICHIGAN, ANN ARBOR, MI

Mr. SADE. OK. Thank you, Mr. Chairman.

I don't have a prepared statement, but I will try to answer as though Dr. Banks were here, any of the questions. He has prepared a statement which I am sure has been submitted to the record, but I had not proposed to read it.

Mr. NELSON. OK, that is fine. We will insert that in the record. Dr. Donahue.

[The prepared statement of Mr. Banks follows:]

TESTIMONY TO THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS

from

Peter M. Banks

Chairman, SESAC Task Force on Scientific Uses of Space Station
and
Professor of Electrical Engineering
Stanford University

July 21, 1986

Mr. Chairman and Members of the Subcommittee on Space Science and Applications. I am Peter Banks, Chairman of the NASA SESAC Task Force on Scientific Uses of Space Station (TFSUSS), and a Professor of Electrical Engineering at Stanford University. With respect to today's hearing it is also relevant to mention that I have been a Principal Investigator on two past Space Shuttle scientific experiments and I am currently leading a team of investigators associated with experiments using the U.S.-Italian Tethered Satellite System-1 mission. I appreciate the opportunity to be here today to discuss problems relating to NASA's plans for realigning its space science program in the confusing aftermath of the Challenger accident. I will give special emphasis to these plans as viewed in the perspective of Space Station science goals.

By way of background, I should say that the TFSUSS discussed many of the space science payload issues during a May meeting of the Task Force at the Goddard Space Flight Center. Dr. Edelson made a presentation on the impacts of the current Space Shuttle Start-Up Manifest to the Task Force and there was a lengthy discussion of the issues. The outcome was support for the OSSA plans but concern that not enough top-down attention was being given to integrating plans for specific missions with the overall needs of the national space science community during the coming five years when there will be little access to space. I will talk more about this later.

Since the Task Force meeting, I have also been consulted by persons within OSSA with respect to updates to the plan as conceived by Dr. Edelson and presented to others within NASA . However, with events such as the decision to remove Galileo and Ulysses from STS and Dr. Fletcher's announcement last week that the first test launch of the shuttle will be delayed until early 1988, even the most recent schedules and plans lack accuracy. Thus, my knowledge will not necessarily be up to date with regard to dates for specific missions planned over the next five years, but I believe that the conclusions I can draw from the present situation won't suffer on this account and will be of interest to you in your deliberations.

To begin, let me say that the prospective 18 month delay in resuming STS flights creates a crisis for this country's space research program. The combination of prior flight commitments to the Department of Defense, the perceived NASA obligations to commercial users, and the active stream of OSSA payloads and individual experiments coming to completion creates a situation where an increasingly large backlog of highly qualified payloads must wait for transportation to space. In terms of the resumption of science payload activity, recovery from this period will take at least four years and, unless special care is taken, even longer term effects will be seen in academic institutions where small research groups composed of graduate students, staff, and faculty will gradually disintegrate unless special actions are taken in this interim period.

Uncertainty about the actual cargo handling capacity of the STS also is confusing: Many things possible with a fourth Orbiter available in 1990 are impossible with a three Orbiter fleet having the present set of user responsibilities.

This complex situation leads my discussion to a number of important questions, including the following:

a) What is NASA's priority for OSSA payloads (full and partial) relative tc the priorities for other users?

b) What steps are being taken to insure opportunities for scientific productivity and program continuity from the space science community during the (at least) five year period of reduced science flights?

c) How can NASA justify spending money for continued science payload development if it is so apparent that there will be a substantial slowdown in flight opportunities even after the STS is again operational?,

d) In these difficult circumstances, what steps should be taken to prepare for Space Station scientific research?, and

e) Should a reduction of shuttle science payloads be sufficient reason to adopt a planned postponement of Space Station IOC?

In the following I propose to discuss each of these issues, giving recommendations which are consistent with the views of the TFSUSS and opinions derived from my own experience as a space scientist.

Payload Priorities:

There is a clear internal disagreement within NASA concening the rescheduling of OSSA payloads. Code M's five year flight manifests put major delays (2 to 5 years, including the recent January, 1988 STS restart date) in the launching of free-flyer payloads and Space Shuttle attached payloads. OSSA has objected to this schedule and proposed a more aggressive alternative manifest which assigns approximately 1 out of 3 STS flight opportunities to OSSA free-flyer and attached payloads. The OSSA manifest schedule for attached shuttle payloads seeks early flight opportunities for eight separate missions: The alternative Code M manifest would result in an average additional one year delay, on the average, for these same activities. When it is considered that an aggregate of over 208 scientific investigators are involved in the attached payload activities alone, some measure of the practical importance of adopting a strong OSSA manifest is clear.

The TFSUSS supports the OSSA approach on the following basis:

1) it negotiates a balance between the potential users of STS which is similar to what existed prior to the Challenger accident. In this regard, it recognizes affirms the responsibility NASA has to pursue a general program of scientific research in space.

2) It permits OSSA to launch its important payloads more expeditiously than would be the case with the Code M manifest, helping to mitigate the severe programmatic effects of flight delays on supporting academic insititutions and NASA Field Centers, and

3) The OSSA manifest for attached payloads is a balanced approach, involving both the an understanding of the need to get large free-flying payloads to space quickly, and recognizing that the science program for space station will greatly benefit from precursor attached payload experiments which require intensive human assistance in space.

In the past the TFSUSS has given special attention to the attached payload program for the reason that it is important for human-assisted science to be practiced in space prior to space station IOC. Unlike unmanned observational science, with its fine history of space accomplishments, human-assisted science in space has had only brief flight opportunities to gain experience with optimizing the use of human resources. Such experience is crucial for on-orbit operations related to situations where the course of the experimental work depends upon real time observations and control from the local investigator. The key to reaching the standards set by ground-based research laboratories is to create a situation where new phenomena and/or behavior can be readily recognized by the human experimentalists and new actions immediately taken in response this. For the life sciences, materials science and applications, and other general fields heavy involvement of humans will be essential. Time accumulated in space with Spacelab and other attached payloads are important for gaining important experience which will aid in the operational and practical plans for Space Station.

As a consequence, it is the recommendation of the TFSUSS that in selecting payloads for STS over the next five years, NASA give careful attention to activities which require close attention and participation by the STS crew, affording them every possible opportunity to conduct experiments in space with STS payloads. In this way we will have made the best use of a precious resouce and helped make adequate preparation for use of a facility whose scientific success will depend upon the effective use of humans in space.

Science Productivity :

I am deeply worried about the direct and lingering effects of the gap in access to space. In particular, academic institutions lack the means to support graduate students, staff and even faculty over the difficult five year period of reduced flight project funding, if that is to be the case. In some disciplines the gap may mean that an entire generation of graduate students will be unable to participate in consumated experimental activities. This significantly reduces the attraction of space research to prospective students and faculty and, unless special steps are taken, it can only lead to a decrease in the overall number and quality of emerging space science and engineering graduates over the next decade.

It is important to understand the way graduate students are supported for their academic and research work. Very few fellowships are now available for graduate students and most depend upon support by funds from research projects. Unlike the situation in an industrial setting or government laboratories, when there is an abrupt break in project funding, no alternate support in the form of industrial IR&D is available within universities to continue the project or individual salaries. As a consequence, students and supporting staff are completely lost in a short period such that if the project were to be restarted several years later, the accumulated talent and special knowledge originally present in the project wold have been largely dissipated and years may be required to reach the previous level of competence.

It is my belief that some of the sting of the present situation can be mitigated by substantially increasing funding for various science activities within OSSA. In particular, Research and Analysis and Mission Operations andData Analysis funding to the scientific community could be increased in this period with significant positive impact upon the overall science program. A number of spacecraft are still providing important scientific information and additional investigations could be mounted through Guest Investigator activities. Likewise, many Spacelab experiments have received inadequate data analysis funds: Renewed or increased support would enable more indepth scientific analyses with consequent increase in scientific productivity. The cost of such increases would be small in comparison with actual space experiments: An opening enhancement of $10-15 million in redirected 1987 funds, opening to perhaps $20 to 30 million by 1989 and closing thereafter, if placed in these budget categories , would have a dramatic, positive impact upon the vitality of the space research community during the years of flight restriction.

It is also possible to consider enhancements to NASA's sub-orbital program, giving opportunities to some individuals to continue instrument development and/or new observations. In a similar vein, the proven success of various theory programs shows that enhancements in this area could be a positive step during a time of general difficulty and provide important background to new experimental activities when it is again possible to return to space.

Continued Instrument and Payload Development:

The absence of flights removes the opportunity to acquire new experimental information from space instruments. However, with the long preparation times (2 to 4 years) needed to actually go to space, it is not reasonable to stop all experiment developments or to unilaterally delay starting new activities. Continuation of ongoing instrument and payload development is a wise decision, permitting current cost development of science projects and giving a lead time to the various research groups to prepare for periods of low activity in the future. With respect to new experiments or other activities, some slowed development may be most appropriate now but, because of the long lead time for virtually all activities, no attempt should be made to stop these plans and special efforts must be made to enhance other space research-related activities.

Relationship to Space Station:

The TFSUSS is convinced that it would be very difficult to construct the currently planned space station with only three STS Orbiters. An important recommendation from its most recent meeting was that NASA consider various alternative launch capabilities, including a shuttle-derived expendable launch vehicle, and the possibility that major hardware be delivered to orbit with smaller ELV's. However, even after IOC it is difficult to see how the required resupply and science support missions for Space Station could be accomodated with the presently stated needs of other users.

With four Orbiters the construction and resupply models become more believable. Concern in this situation then begins to focus on how to make adequate use of the limited number of STS science payloads for best long term advantage. Towards this goal, the Task Force feels that whereever possible, free-flyers should be launched from ELV's: The resources of the STS should be reserved to promote activities which have a bona fide need for human resources and/or the Orbiter large lift capability.

NASA's present list of attached payload missions represents a balanced program which provides each discipline with opportunities to both acquire new scientific information and to gain experience with the complexities of on-orbit human support. Given the relatively long time needed to integrate the lessons learned from these experiences into the investigator community and the NASA support teams from the various Field Centers, it is clear that it is important to maintain the level of STS scientific work proposed by the OSSA manifest and to continue to press for new flight opportunities in the period from 1992 on to space station IOC. Only in this way will we be fully prepared for space station science operations.

Another approach might be to greatly abbreviate the current STS science program with the intent of restarting intensive, human-assisted research work later with the Space Station. Such a plan would have serious consequences which would greatly harm space research and related technology development. These are:

> 1) It would destroy the science and career plans for a large fraction of the space research community. Significant numbers of graduate students, staff, and faculty committed to Space Shuttle science activities would direct their interests elsewhere, with consequent loss of momentum and national technical capabilities in various scientific disciplines,
>
> 2) Such a decision would result in the further withdrawal of academic institutions from the space program, affecting our ability to train students in space-related topics which carry over into a wide variety of other fields, including the aerospace industry and Defense Department programs,
>
> 3) The learning curve for Space Station science activities effectively would be protracted, and the quality of work would most certainly suffer,

4) There would be an increased gap in our national capabilities with respect to life sciences and materials research in space relative to those capabilities now being developed by the USSR. The Mir space station will be available to both Soviet scientists and their invited colleagues for approximately 8 years before we have permanent facilities in space. To delay our research and other technical investigations in these areas beyond what we must already endure with the current flight gap is not a prudent action.

Postponment of Space Station:

Although the STS science payload activities are important in preparation for Space Station IOC activities, they aren't sufficient reason for serious consideration of a delay of IOC. There is general agreement in the space science community that STS has not been able to deliver the capabilities originally planned for support of scientific investigations in space. The reasons include the complexity of designing accomodations for multi-user payloads, the difficulties STS has in meeting specific operating requirements (launch times, orbits, attitudes, etc.) required by scientific investigators, the relatively short time on orbit, the lack of science-dedicated, on-board computational and communications devices, the lack of sufficient power and/or energy, and so forth. Thus, the attitude of the science users is that STS payloads represent an important first step towards Space Station, and that such flights are important opportunites to develop capabilities in all space research disciplines. However, the real payoff for science, as measured in a variety of ways (quick flight opportunities, access to crew, repair and service support, large operating volumes/areas, increased power, more science support equipment, etc.) will come with the next generation of activities on the Space Station. And the sooner the Space Station arrives, the better it will be for an important class of science users who require the resources of this important, new facility.

From this perspective, it is clear that a delay in IOC will be a loss in terms of opportunities delayed and capabilities lost. And, in the face of our international commitments, associations, and competition, it may be that such a delay will result in serious problems to this national as a whole. I would urge this committee to take such actions that would result in both rebuilding the Orbiter fleet and to holding the date for IOC to current plans. Those actions, in the eyes of the Task Force and the general space research community, would be visible evidence of this nation's commitment to space, a commitment which has already been accepted for more than a decade by our chief competitor.

I would be pleased to respond to any questions that you might have regarding this testimony. Thank you for the opportunity to be here today.

Mr. DONAHUE. Thank you, Mr. Chairman for asking me to appear before you this afternoon to discuss the crisis in space science after the *Challenger* accident.

I have submitted a statement, which I understand you have. I certainly don't propose to read it, but I will summarize the principal points in the statement.

It makes the point that hardly needs to be made, that is that the *Challenger* accident has brought home to us the realization that there were fundamental structural flaws in the space program of the United States, and these were a consequence of the fact that the shuttle became our only means of access to space, we forswore the use of expendable launch vehicles while, in fact, the shuttle was still a developmental vehicle. So we were behaving as though it was an operational vehicle.

A couple of months ago the Space Science Board released a position paper on the expendable launch vehicles that asserts that it is not appropriate to use the space shuttle as a platform to launch spacecraft. It asserts that to try to do so mixes the objectives of the manned and the unmanned elements in the space program in ways that reduce the effectiveness of both of them, thereby threatening our scientific and technological leadership in space. It called for a drastic change in policy that would correct the mistaken policy of relying on the shuttle as the only means of launching scientific missions and once again make expendable launch vehicles [ELV's] the primary system for launching scientific spacecraft.

Since we issued that position paper, several events have reinforced our position. One of these was the cancellation of the Centaur G-prime program. We, as you know, planned to rely on the Centaur as a means of launching many of our high-performance missions to the planets, such as Galileo; the lengthening of the stand-down from 18 months to 2 years or so; and most recently the imposition of strict safety and down-weight requirements on the shuttle that preclude the use of the shuttle for missions such as Galileo and other planetary spacecraft. So in the 2 months that have elapsed since our position paper was issued events have even heightened the crisis, and yet we will still haven't resolved this problem.

Now, I am here this afternoon to urge you to adopt a policy of not using the shuttle as a means of launching scientific spacecraft, but to move right out to acquire expendable launch vehicle. Specifically, I would like to address the traffic jam that exists in the last quarter of 1989, when three high-priority science missions, the Galileo, Ulysses, and Magellan have their windows open, and an opportunity to launch them exists at that time, but not with the shuttle.

What I am challenging, I challenge the assertion that it is not possible to acquire expendable launch vehicle with adequate upper stages to launch those three missions in the last quarter of 1989. Specifically, one means of doing so, that I have in mind, is the Titan 34-D-7, the seven-segment Titan, the complementary expendable launch vehicle [CELV] that is being developed by Martin-Marietta at the behest of the Air Force.

If that vehicle, along with Centaur upper stages, can be made available to NASA at that time, then at least some of these missions can be launched. Otherwise, we face an additional 13-month delay for Galileo and for Ulysses, and a 19-month delay of the Venus radar mapping mission, the Magellan mission.

We are talking now about Galileo arriving at Jupiter in 1995, whereas originally it was supposed to get there this year.

Now I have a personal investment in that mission because I am investigator on the thing. I am still fairly alert at the age of 65. I don't know how I am going to be at the age of 74, if I have to look at—but there are a lot of good reasons other than the one I just mentioned for launching Galileo in good time.

So, I am asking you—asking everybody to face the fact that the shuttle is a developmental vehicle and that we can't predict when it is going to become operational. But even after it becomes operational, although it has many fine uses for space science—in life sciences, for example, or as a platform from which to retrieve and service our space science spacecraft, such as the the space telescope, using it as a means of launching spacecraft is not the way to go, in our opinion.

If you ask me, if you press me—and it would be reasonable to do so—to say how we should pay for the acquisition of expendable launch vehicles—assuming that Martin can turn them out, and that we can arrange with the Air Force to share them in some equitable way—then I would reply that for me, for science, the first priority is access to space, that the very first thing this space agency in this country should do is find a way of getting back into space in the most expeditious way.

I don't know how to predict when the shuttle is going to be available, so I would say if I were pushed, that I would acquire ELV's at the expense of acquiring a replacement orbiter at the expense of the slowing down and de-scoping the space station. We just can't—I mean, if we get a fourth orbiter and we keep on track with the space station, we will find ourselves back at January 26, with a system that was broken. So I am urging that we move in a different direction.

I would like to say a few words about the short-term problem of space science and applications, and that is the problems of how we should operate during the stand-down, during the next year or two. Again, I don't think it is a good idea to try to keep on doing business as usual.

There are several things that, as high priority, ought to be done in order to keep—if you want to keep the space science program alive in this country. One of these is certainly to keep existing spacecraft that are up there now in space, operating.

I am just amazed to hear occasionally that there are proposals to turn off some of these spacecraft that we managed to launch some years ago. I urge that not be done, unless they just are not working, unless they aren't producing useful data.

The Sub-Orbital Program, the Explorer Program, even a Planetary Observer Program, extended to all disciplines of space science, should be enlarged so that we can use Deltas in order to get small scientific spacecraft into orbit and begin doing space experiments again.

At the same time, it certainly is necessary to move ahead and made some kind of progress on the long range, on getting programs like AXAF and CRAF and ISTP underway.

Finally, I would say that, when the shuttle does become operational, although there is no contest that national security needs come first, it seems to me a very reasonable and mandatory, the thing to allocate a certain fraction of those early missions on the shuttle to space science and application; something in the order of 30 or 40 percent would relieve a lot of our needs. Then, if we had expendable launch vehicles, we would be getting, with attached payloads that would then fly on the shuttle, we would be on the way back.

Mr. NELSON. Are you speaking for the Space Science Board?

Mr. DONAHUE. Yes, sir.

Mr. NELSON. Unanimously?

Mr. DONAHUE. Well, we were unanimous when we approved our position paper on the ELV's; yes, sir.

Mr. NELSON. Now, what was that about 30 to 40 percent that you were talking about?

Mr. DONAHUE. I am talking about the fraction of shuttle flights that should be devoted—the fraction of the manifest that should be devoted to space science and application. Roughly a third, I would estimate.

[The prepared statement of Mr. Donahue follows:]

DR. THOMAS M. DONAHUE

THE NATION'S SPACE PROGRAM AFTER CHALLENGER: THE NEED FOR A REASSESSMENT OF THE ROLES OF MANNED AND UNMANNED SYSTEMS FOR LAUNCHING SCIENTIFIC SPACE MISSIONS

The Space Science Board of the National Research Council shares with NASA and the Nation a deep sense of grief over the loss of the crew of the space shuttle Challenger--seven exceptional Americans whose lives were dedicated to some of our country's loftiest goals.

At this time of national reflection following the tragedy, much thoughtful consideration is being given to the goals and the future of the American space program. We believe that these reflections on our country's efforts in space are very appropriate. In the course of these considerations we urge that high priority be given to assessing the proper level of resources required for the nation's space program and the proper balance between manned and unmanned activities. This reexamination should assign to manned and unmanned systems and launch vehicles the roles that will permit each to serve the nation best, in contrast to the course we have been following for the past fifteen years. The result of this analysis may call for the allocation of greater resources than we are presently devoting to the space program. It may call for better management of those resources or a mixture of both. In any case, we also believe that it is mandatory to ask whether this nation should proceed with such a highly visible, prestigious national enterprise on the frontiers of technology at an effective level of resources where the consequences of a single tragic accident can cripple the entire program, civilian and military. It is now time to determine the strength of the national will for our country's space effort, and to determine if it is our intent to pursue a pioneering program on the frontiers of space embracing a wide range of activities. If the nation concludes, as we believe it should, that such a course is in the national interest, then it should resolve to devote to that effort the means to carry it out properly.

Since 1974 the annual budget for the civilian space program has remained almost constant at about $7.5 billion, corrected for inflation to 1986 dollars. In contrast, the peak funding level in the mid 1960s--in the midst of the Apollo program--was three times as large. This substantial reduction in our space effort reflects a decision that was made at the conclusion of the Apollo program not to provide the means to undertake soon another ambitious, challenging space program similar to the one that had placed men on the Moon and returned them to Earth. Furthermore, following Apollo the nation failed to identify any clear goals for its space program, but, nevertheless, tried to attain a level of activity well above the limit set by the means that have effectively been available.

The major new program in manned space flight that was authorized during the decade of the seventies was the space shuttle, a transportation system that was meant to be the sole national means of access to space and was expected ultimately to be economically self-sustaining. Later, related actions stopped the procurement of expendable launch vehicles before the shuttle became a proven, reliable system; prevented planning for the development of advanced unmanned launch systems; and encouraged planning for two ambitious scientific missions, Galileo and Ulysses, to use the shuttle in a manner that would severely test its capability in the first attempts to launch high priority science spacecraft. These decisions had the effect of making unmanned space missions, including those of space science, dependent on manned vehicles, the shuttle in particular, in a way that caused serious problems for both aspects of the space program. This policy, which has deprived the nation of launch vehicles for major scientific payloads for almost a decade, has been devastating for space science.

The most recent launches of major science payloads requiring launch systems of the Titan-Centaur class occurred in 1977 when the two Voyager spacecraft were sent off toward the outer solar system. In the mid 1960s, scientific missions were being launched at a rate of 5 to 6 per year by the United States. A measure of the level of activity and reliability of the U.S. program before 1980 is that 9 interplanetary missions that were launched during that period are still sending valuable data from space. The Challenger accident means that at least a full decade will have lapsed between the launching of the Voyagers and the next major scientific mission by the United States. Seven full scale scientific missions have been or are being prepared for launches that were scheduled to occur during the next two years. Several others were waiting in line behind these. In the meanwhile other nations have been methodically picking up the pace and improving the quality of their scientific enterprises in space.

As a matter of highest priority in a reenergized national space program to which a realistic level of support is dedicated, we strongly urge that the nation move rapidly toward the acquisition of a balanced fleet of launch vehicles that will provide assured access to space for all activities demanded by our national space program. The characteristics of these launch vehicles should be determined by the needs and requirements of all potential users--military, commercial, and space science. We recommend that space transportation and launch systems be expeditiously acquired that will allow human resources to be used where they are needed and can be most effective and allow unmanned vehicles to be the carrier of choice for other missions. A policy that merely provides for the use of existing commercial expendable launch vehicles would not be an adequate response to this recommendation.

In summary, it is our view that one of the most important lessons from the Challenger accident is that the objectives of a highly visible and important national endeavor such as our space program must be clearly stated, that an adequate variety and level of resources should be provided to carry out this program successfully, and that measures be taken to insure that those resources are efficiently managed. These resources should assure access to space to all elements in the space program: civilian and military, manned and unmanned. The objectives of the manned and unmanned elements of the program should not be mixed in ways that reduce the effectiveness of either of them. To do so risks forfeiture of our scientific and technological leadership in space.

Mr. NELSON. All right.

Let's get our three NASA managers up.

Dr. Edelson, Mr. Hodge, and Dr. Colladay, if you all will come up?

The two of you please stay, Dr. Donahue, Mr. Sade.

I want to clarify your remarks. You said, Dr. Donahue, that the board, your board, the Space Science Board of the National Academy, concurs in your opinion as expressed to you with regard to ELVs; does your board concur in your statement that you expressed about funding for the space station, vis-a-vis, the science missions?

Mr. DONAHUE. Well, that issue hasn't been put explicitly to the Space Science Board. It is implicit in the position papers that we issued on the space station a couple of years ago, and on the position paper that we issued with regard to the expendable launch vehicles this year.

Dr. Edelson.

STATEMENTS RAYMOND S. COLLADAY, ASSOCIATE ADMINISTRATOR FOR OFFICE OF AERONAUTICS AND SPACE TECHNOLOGY, NASA; BURTON I. EDELSON, ASSOCIATE ADMINISTRATOR FOR OFFICE OF SPACE SCIENCE AND APPLICATIONS, NASA; AND JOHN D. HODGE, ACTING ASSOCIATE ADMINISTRATOR FOR OFFICE OF SPACE STATION, NASA

Dr. EDELSON. I have an oral statement, Mr. Chairman.

Mr. NELSON. If you want to summarize it for us, that will be fine.

Mr. EDELSON. Yes, sir.

The loss of Challenger, the extended shuttle downtime, and the termination of the shuttle Centaur have together had a major impact on the Space Science and Applications Program. What we had originally anticipated to a year for space science, has instead become a year of disappointment and reassessment for the space science community.

We are currently in the process of formulating a plan to maintain progress in the Space Science and Applications Program and developing a strategy to maintain the health of the program during this hiatus.

It is clear that science and application missions face major delays for both free flyer and attached missions. These delays have serious implications for the acquisition of scientific knowledge, the overall health of the science program, and the maintenance of the required technical and scientific expertise needed to sustain the program.

Our pre-*Challenger* schedule planned for the launch of the Astro-Halley mission this past March, the Galileo and Ulysses missions last May, and the Hubble Space Telescope this fall. We are now faced with difficult task of maintaining these very complex systems pending launch when circumstances permit.

This situation is definitely serious. If we resume launching of the shuttle in the first quarter of 1988, as now planned, the Hubble Space Telescope will slip about 20 months from its earlier planned date; the Galileo mission to Jupiter will arrive approximately 6 years later than a pre-*Challenger* plan.

Our shuttle attached payloads, including important life sciences and microgravity science missions will slip on the average of about 4 years. We are working to quantify the cost impact of all of these mission slips.

Our problem is really to keep the flight program teams together during the hiatus, maintain the vigor of the various disciplines in the science community, including universities; to shift our resources to determine which missions to modify or to cancel, and develop a launch schedule for these delayed missions.

We are addressing the missions on two fronts. First we are working with the NASA staff, our various advisory committees and representatives of the science community to develop a strategy to keep our momentum and to get the program back on track. Second, we are working to maintain the vitality of our programs during the flight hiatus.

For my first point, I believe it is important for the agency to set some general directions. First, I think that NASA should reconfirm our goals to emphasize science and exploration as primary thrusts for the agency, and to consider the shuttle and the space station as means to reach these important ends.

I think we should launch the Hubble Space Telescope as early as possible in our new manifest. The Hubble Space Telescope is a symbol to the science community, the centerpiece of our Space Science Program.

An early launch would demonstrate our Nation's commitment to the continuing scientific exploration of space. We should consider, and if possible, move to mixed-fleet concept, using the shuttle and expendable launch vehicles to maximize performance, flexibility, cost effectiveness, reliability, and safety. We are developing plans now for launching those missions that we can on ELV's.

With regard to my second point, we are concerned with maintaining the vitality of our research programs during this hiatus. We are investigating innovative ways to preserve the health of the program and provide opportunities in the various disciplines.

One way to do this is to promote some near-term scientific projects, plan activities now that can come to fruition in just 2 or 3 years, and carry through with activities that will sustain public interest in the scientific exploration of space.

To do this we are considering some seven areas of opportunity within which we can enhance the vitality of research program as a whole.

These are—and I will not go into any detail on them—enhance our data analysis programs; enhance our sub-orbital program, make increased use of airborne science, rockets and balloons to provide increased science in those areas; to develop new scientific instruments for later flights; to go to smaller payloads, for example, the development of a Scout-compatible, non-retrievable Spartan; to investigate options to piggyback science payloads with those of other agencies, such as NOAA, DOD; to investigate some special flight opportunities on the Scout and on the Delta; and to develop cooperative programs with others; with other Government agencies and with our foreign partners, such as the European Space Agency and Japan.

This planning is all ongoing. As the plans become firm, we will provide more specific information to the subcommittee.

I will conclude with the observation that although we are confronted with some very significant challenges to our program, we are working as hard as we can to address them and to provide solutions for the short and the long term. We won't give up on this.

Thank you, Mr. Chairman.

[The prepared statement of Dr. Edelson follows:]

NASA
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July 21, 1986

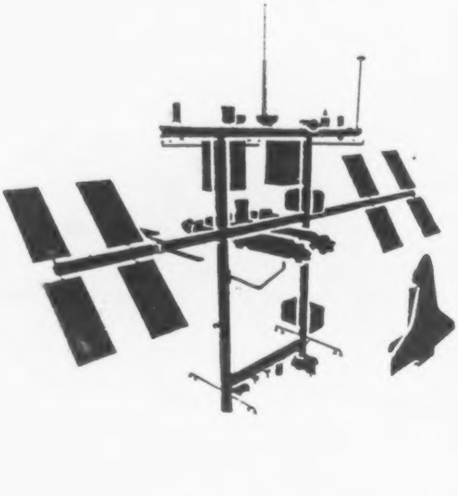
Subcommittee on Space Science and Applications

Committee on Science and Technology

House of Representatives

Statement by:

Dr. Burton I. Edelson
Associate Administrator for
Space Science and Applications



99th Congress

Statement of

Dr. Burton I. Edelson

Associate Administrator for Space Science and Applications

National Aeronautics and Space Administration

Before the

Subcommittee on Space Science and Applications
Commitee on Science and Technology
United States House of Representatives

Mr. Chairman, Members of the Subcommittee:

The loss of Challenger, the extended Shuttle downtime, and the termination of the Shuttle-Centaur have together had a major impact on the Space Science and Applications program, and what we had originally anticipated to be "a year for space science" has instead become a year of disappointment and re-assessment for the space science community. We are currently in the process of formulating a plan to maintain progress in the Space Science and Applications Program, and to develop a strategy to maintain the health of the program during the hiatus.

It is clear that the various options for manifesting Science and Applications missions involve major delays for both free flyer and attached missions. These delays have serious implications for the acquisition of scientific knowledge, the overall health of the science program, and the maintenance of the required technical and scientific expertise needed to sustain the program. Our pre-Challenger schedule planned for the launch of the Galileo and Ulysses missions this past May, and for launch of the Hubble Space Telescope in the Fall of this year. We are now faced with the difficult task of maintaining these complex systems in a ready state pending launch when circumstances permit.

The situation is serious. If we resume launching of the Shuttle in the first quarter of 1988, the Hubble Space Telescope will slip about 20 months from the earlier planned date; and the Galileo mission to Jupiter will arrive approximately 6 years later than the pre-Challenger plan. Our Shuttle attached payloads, including important life sciences and microgravity science missions will slip approximately three to four years. We are working to quantify the cost impact of mission slips.

Our problem is to keep flight program teams together during the hiatus, maintain the vigor of the various disciplines in the science community, including U.S. Universities, and develop a strategy to get the Space Science and Applications program underway again as quickly as possible. We are addressing this issue on two fronts. First we are working with NASA staff, our various advisory committees and representatives of the science community and industry to develop a strategy to get the program back on track. Second, we are working to maintain the vitality of our research programs during the flight hiatus.

First , I believe it is important for the Agency to set some general directions for Space Science and Applications. I believe the following guidelines will be helpful.

- Reconfirm NASA's goals to emphasize science and exploration as primary thrusts for the agency.

- Launch the Hubble Space Telescope as early as possible in the new manifest. The HST is a symbol to the science community, the centerpiece of our space science program. An early launch would demonstrate the Nation's commitment to the continuing scientific exploration of space.

- Consider a "mixed fleet" concept using the Shuttle and ELV's to provide safety, reliability, flexibility and cost effectiveness.

Second, we are concerned with maintaining the vitality of our research programs. In that regard, we are investigating innovative ways to preserve the health of the program and provide opportunities in the various disciplines.

One way to do this is to promote some near-term examples of good science, to plan activities now which can come to fruition in just 2 or 3 years, and to carry through with activities that will sustain public interest in the scientific exploration of space. To do this, we are considering several areas of opportunity within which we could enhance the vitality of the research community as a whole. These are:

1. Enhance our data analysis programs to gain new information and accelerate the data products. Here we focus on the multispectral analysis of Astrophysics data from prior successful missions such as the Infrared Astronomical Satellite (IRAS), the High Energy Astronomy Observer (HEAO), Spacelab-2, the International Ultraviolet Explorer (IUE), Solar Maximum Mission (SMM), and on the abundant Planetary data from the Voyager and Pioneer spacecraft.

2. Enhance the Sub-orbital Program to maintain alternate flight opportunities. This would potentially include increased utilization of aircraft, rocket and balloon capabilities, an acceleration of the airborne observatory program, and enhancement of payloads to maximize data return.

3. Develop new instruments. Here we are considering enhancement of ground-based laboratory facilities and reconfiguration of payloads which are currently using older technology. The updating of these facilities would support missions once we fly again.

4. Small payload development. Certain examples include development of Scout-compatible, non-retrievable Spartans.

5. Investigate options to "piggyback" Science and Applications payloads with those of other agencies such as the National Oceanographic and Atmospheric Administration (NOAA) and the Air Force Space Test Program (AF/STP).

6. Investigate special flight opportunities. Here we are exploring the use of Scout or Delta vehicles to accommodate backlogged payloads in the various science disciplines, and are considering negotiating for acquisition of these vehicles.

7. Develop cooperative programs with others. Discussions are underway with some of our international partners such as the European Space Agency (ESA) and Japan, and with other U.S. government agencies.

Much of this planning is in the early stages. As these plans become firm, we will be in a position to provide more specific information to you. Of course, the plans are subject to any contingencies that may arise from the recovery of the Challenger accident.

I will conclude with the observation that we are confronted with a significant challenge to our program management responsibilities. However, I also will say that we are working hard to address the problems, and to provide solutions for the short and long term.

Thank you.

Mr. **Nelson**. Nor will the American people in what they expect of America's space program, Dr. Edelson.

Dr. **Edelson**. Thank you, sir.

Mr. **Nelson**. All right.

Dr. Colladay.

Dr. **Colladay**. Thank you, Mr. Chairman. I am pleased to have this opportunity to discuss the impact of the shuttle tragedy on OAST technology flight experiments, and take advantage of forums such as these to point out the importance of technology and engineering development, as well as space science to the mission of the agency and our future in space.

I think it is generally accepted, or at least intuitively obvious, that engineering know-how for building, and operating space-based hardware and complex space systems is vital to long-term U.S. interest in space. The key element in building that know-how is a proven engineering data base, from on-orbit technology experiments where a ground-based simulation just is inadequate. The shuttle provides a unique capability to do this type of testing by virtue of being able to bring a test article back for analysis and reflight, or by virtue of being able to involve the astronaut in the test procedures themselves.

It is also a fact that we don't receive or even expect the same visibility for technology and engineering experiments that the space science missions enjoy. Technology and engineering flight experiments are means to an end, rather than an end in themselves. But believe me, they are vital to our long-term interest in space.

We have been building up our research, technology, and engineering program in OAST since the first shuttle flight, and have had technology experiments on every single mission. They have ranged from fluid handling experiments with two-phased flow, thermal management experiments, large flexible structures, and in fact, many of the experiments that are so eloquently exhibited in the "Hail Columbia" and the "Dream is Alive", both of those films describe technology experiments that are in the engineering data base that we have been testing.

The impact of environment on materials such as atomic oxygen attacking coatings, and construction and deployment of large structures like the test that we did on the December flight last year that we called, EASE-ACCESS, are but a few examples. These relatively simple experiments of the past have been building in size and complexity leading to a series of larger experiments that were planned for the next several years.

The first of these more complex technology development flight experiments planned for the future when the shuttle flights resume, is to evaluate the behavior of truss-like structures in zero gravity. In particular, I would say it is not now possible to analytically predict, with any accuracy, the dynamic response and control of large very flexible structures. The first in this series of control of large flexible structure tests will be a 60-meter beam, made of truss elements which will be tested to evaluate their response and control in maintaining stability. The first model, now in the design phases, and with a ground-based research program is leading to flights planned in the 1991 timeframe. The first series of experiments will be followed by more complex three-dimensional structure, like an antenna, and finally distributed mass connected by flexible structure which require distributed active control systems to maintain stability.

The second of three series of technology development experiments that I will be describing is a series which concerns the management of cryogenic fluids in space. With space-based transportation systems we need to be able to understand how to store and transfer fluids, particularly cryogenic fluids, in a zero-gravity environment. The ability to do so simply can't be simulated on the ground in the earth's surface. The first of these experiments is a series to evaluate the transfer of liquid hydrogen to, and from, tanks using various concepts for retaining and gauging the fluid during the transfer maneuver. The experiment series needs to be started in the early 1990s, as well, to support plans for, for example, an orbital transfer vehicle.

The third series has to do with flight experiments to evaluate a concept of aerobraking in an orbit transfer vehicle. I have described that to you on several occasions, and to the subcommittee previously. Ground-based wind tunnels are not able to simulate the entry environment encountered during the aerobraking maneuver. We plan to launch an experiment from the shuttle bay, the test article with a heat shield and a control system, reenter the earth's atmosphere, and then back into space, recover the test article, reinstrument it and look for other parametric variations that need to be explored with the anticipation of flying the device again. That is typical of the way engineering and technology experiments are done using the shuttle.

We plan to proceed with an outreach program to stimulate the aerospace engineering community, including universities, to participate cooperatively with NASA in the conduct of in-space engineering experiments. We are used to dealing with the engineering community in that role in our aeronautics program. Here the shuttle is analogous to a wind tunnel and the shuttle will be a stepping stone for similar space-based technology experiments on board the space station. We have also continued to use the shuttle as we have on each flight, as an instrumented model to further our understanding of entry research supporting hypersonic flight.

Finally, we must recover the Long Duration Exposure Facility (LDEF), or very long duration exposure facility now, by 1991 before it reenters the atmosphere. There are a number of very important experiments on board the LDEF, and not only do we want to return the structure to reuse again, but that data on those flight experiments is very valuable to us.

In conclusion, I see a continuing and building need for engineering in-space research that will provide the design tools, the understanding and the verification for building and operating complex space systems of the future.

We are continuing to evaluate the impact that recovery from the shuttle tragedy will have on the OAST programs. Although our plans are being adjusted, we fully expect to continue a vigorous and productive program.

Thank you, Mr. Chairman.

[The prepared statement of Dr. Colladay follows:]

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July 21, 1986

Subcommittee on Space Science and Applications

Committee on Science and Technology

House of Representatives

Statement by:

Raymond S. Colladay

Associate Administrator
Office of Aeronautics and
Space Technology

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ADVANCED
RESEARCH
SPACE TRANSPORTATION

99th Congress

STATEMENT

OF

Dr. Raymond S. Colladay
Associate Administrator for
Aeronautics and Space Technology

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

before the

Subcommittee on Space Science and Applications
Committee on Science and Technology
House of Representatives

Mr. Chairman and Members of the Subcommittee,
Thank you for this opportunity to discuss OAST in-space experiments.

The advent of Shuttle flights has provided the opportunity to complement ground-based research with in-space research as appropriate. In-space research becomes appropriate when the conditions found in space cannot be simulated on earth or when the cost of such simulation is so high that it is more economical to conduct the research in space. In an engineering sense, in-space experiments provide data on the effects of the environment on materials or engineering subsystems, or they may be used to verify analytical predictions of behavior of new concepts which could be used on future systems.

We have been using the Shuttle to conduct experiments within and outside the payload bay. As examples, the drop dynamics module and the super critical helium experiments conducted in 1985 have helped us to understand and predict the behavior of fluids in space. These experiments studied the dynamic behavior of droplets in space and the unique properties of super fluid helium which is used for low temperature sensor applications. Early in the Shuttle program, we encountered an unexpected erosion of surface materials in the payload bay. OAST has conducted a number of experiments subjecting a large number of samples and protective coatings to the space environment to evaluate the effects of what has been shown to be the aggresive properties of atomic oxygen in low earth orbit. In another engineering experiment we have conducted initial experiments of two phase flow heat pipe concepts to verify their behavior for thermal control with active fluids in the zero-G environment. The most visible and striking engineering research to date has been the two experiments conducted in December of last year to evaluate the ability to deploy and to assemble truss-like structures in space. Two concepts were studied, one involving a deployment capability and both involving the intervention of humans in EVA to assemble structures.

These realitively simple experiments of the past have been building in size and complexity leading to a series of larger experiments that were planned for the next several years. The first of these more complex technology development flight experiments planned for the future when shuttle flights resume is to evaluate the behavior of truss-like structures in zero-G. In particular, it is not now possible analytically to predict with accuracy the dynamic response and control of large flexible structures. To gather fundamental response data and to evaluate analytical predictive methods, we are now designing and fabricating experimental devices and instrumentation for tests of successively more complex structures. The first is a sixty meter beam made of truss elements which will be tested to evaluate their response control techniques for maintaining stability. The first model is now in the design phase leading to flights in the early 1990's. The first series of experiments will be followed by a more complex three dimensional structure and finally by a structure which is not only three dimensional but would employ concentrated masses in simulation of structural components one might expect on large spacecraft.

The second large experiment series concerns the management of cryogenic fluids in space. As we lead to concepts of space basing of transportation nodes, we will require the ability to store and transfer cryogenic fluids in the zero-G environment. The ability to do so cannot be simulated on the earth's surface. The first of these experiments is a series to evaluate the transfer of liquid hydrogen to and from tanks using various concepts for retaining and gauging the fluid during the transfer maneuver.

For the third series, we have completed the conceptual design of a flight experiment to evaluate the concept of using aerodynamic braking for an orbit transfer vehicle from low earth to geosynchronous orbits. The advantage of the concept is a greatly reduced propellant requirement which could result in a doubling of the payload capability from low to geosynchronous orbits. In this case, ground based wind tunnels are not able to simulate the entry environment encountered during the aerobraking maneuver. We plan to launch an experiment from the Shuttle bay, raise the assembly to higher elevation and then accelerate it back to the atmosphere to perform the aerobraking experiment and then recapture the body after the maneuver by the Shuttle. The test article would be heavily instrumented to understand the aerothermodynamic and material responses and the recovery will allow us to determine directly the impact of the heat loads on the heat shield design.

We are also initiating a program to stimulate the aerospace engineering community, including universities, to participate cooperatively with NASA in the conduct of in-space engineering experiments. This program is intended to provide a research opportunity similar to that which has existed in the aeronautics engineering community through the cooperative use of national wind tunnel facilities. We will also continue to use the Shuttle, as we have in each past flight, as an instrumented model to further our understanding of the aerodynamic, aerothermodynamic, and materials response of reusable entry vehicles.

Finally, we must recover the Long Duration Exposure Facility by 1991 before it reenters. Recovery of this facility is critical to the many participating experimenters who represent a broad cross section of the international community.

A general characteristic of engineering in-space experiments is the requirement to return the test articles to earth. When we are studying the effects of the space or entry environment on materials or devices, we must recover the experiment to observe and measure the effect. When we are studying new concepts, we run a series of tests by reusing hardware, instrumentation and control software, but reconfiguring the test to broaden experimental parameters. As a consequence, the Shuttle with its return capability is the only vehicle capable of performing a large number of engineering experiments. In addition, some engineering experiments, such as those to evaluate assembly and repair, require astronaut involvement in conducting the experiment. We see a continuing and building need for this type of engineering in-space research that will provide the design tools, the understanding, and the verification for building and operating space hardware and complex on-orbit systems of the future. We are continuing to evaluate the impact that recovery from the Shuttle tragedy will have on the OAST program. Although our plans are being adjusted, we fully expect to continue a vigorous and productive space technology program.

Mr. NELSON. At what point would the LDEF start to degrade in its orbit?

Dr. COLLADAY. Early 1991, sir. It drops to an altitude of about 160 miles and becomes unstable, so we have to revisit it, either to recover it or to boost its orbit some time in 1990.

Mr. NELSON. Well, under our present scenario that shouldn't be a problem, should it?

Dr. COLLADAY. It shouldn't. It is being considered in the look of the manifest for that time period.

Mr. NELSON. Now, are there any science experiments on board that we are going to lose as a result of this long?

Dr. COLLADAY. Yes, sir, there are. There are about 15 percent of the experiments are actually enhanced with the extended duration. I would say, maybe another 15 percent, are not affected at all. In the rest of them, the remaining 70 percent are degraded significantly and some of them totally destroyed as a result of the extended duration.

Mr. NELSON. I see.

The optimum time for collection of LDEF would have been how many months after its——

Dr. COLLADAY. It was launched in 1984 with a planned 12-month on-orbit duration. After the 12 months some deterioration started in most of the experiments. That would have been 1985. So if we pick it up in 1990 that is 5 years extended.

Mr. NELSON. At one point I had heard that you were considering taking one of those missions at the end of 1985, either 51-J or 61-C, and trying to go up and retrieve LDEF after the satellite had been deployed; what was the thinking there?

Dr. COLLADAY. That was in the plan, Mr. Chairman, before the accident, to retrieve it. We had a window of possibility in the late 1985, that you are referring to, and then it was manifested, I believe, in September 1986, as a planned recovery with an option to consider an early flight in late 1985.

It turned out there was a difficulty with that because in order to accomplish it, we would have had to move some of the satellite launching structure with an EVA activity. Because of the size, LDEF required a good portion of the payload bay, but it was firmly manifested before the accident for September 1986.

Mr. NELSON. OK.

Mr. Hodge.

Mr. HODGE. Thank you, Mr. Chairman. I appreciate this opportunity to talk to you about the utilization of the shuttle for the Space Station as we develop our design over the next several months.

I do have a short prepared statement. I will just summarize some of the major points from that.

Let me say first that we are presently in the Space Station Program in the period of what we have called, definition and preliminary design. You will recall as we put the program together, we made a point of extending the definition so that, in fact, when we bring the hardware on board, when we start to build the hardware, that we were in a better position to define the program, define the design, and define how we would buy it in a much more capable way. This was as a direct result of some studies that had been done in NASA over the past several years.

When we announced our baseline configuration at the end of March, we were, in fact, half way through the phase B studies. It was essentially exactly the halfway point, and from that point on we were intending to refine that design and take us through the end of January of next year before we felt we would be ready to bring the contractors on board to start the detailed design and to start to build hardware. So, at the present time, we are about halfway through, a little over halfway through the preliminary design period.

Now on the basis of the design work that we have done to date, and the baseline configuration that we have, we have made estimates of the requirements for the shuttle in the early 1990's. There is no doubt that the space station is designed as a matched pair with the shuttle, and will require a reliable, safe, efficient, manrated system to construct the space station and to utilize it from that point on.

The present baseline and the launch requirements for that baseline are based on the shuttle capabilities which were there in the area of performance prior to the accident. We have as yet, not reconstructed the performance of the shuttle in the 1993 timeframe.

We do not yet know what the performance capabilities will be at that time, although Admiral Truly is presently examining that. Clearly, as a result of the accident we must examine, it would be appropriate for us to examine the implications of a mixed fleet on the construction and utilization of the space station.

As a result of the studies that we have done to date, and since the presentations that we made to this committee last year, the current baseline requires about 20 flights in order to deliver the baseline configuration over a period of between 2 and 3 years. It is about 30 months that we are presently considering.

Directly as a result of the accident, I directed the Space Station Program office, particularly the group at level B at Houston, to reexamine the fundamental premise that we had with regard to safety. The space station had been built on the basis of a safe haven, that was as a result of, actually, the very first study we did on the space station requirements, which showed that we felt that with a robust shuttle fleet that the safe haven concept of allowing the crew to retreat to one of the pressurized modules under conditions of problems on the space station, would provide us with an adequate safety margin.

Clearly, the possibility of a systematic failure of the shuttle, which would bring down the whole fleet, requires us to reexamine that principle. We are, in fact, in the middle of such a study, and I expect the results of that to be available sometime in August.

Mr. NELSON. Well, what are some of the possibilities there?

Mr. HODGE. There is an interesting, almost serendipitous result coming after the study. If, in fact, we do have a mixed fleet, and we can use the expendable launch vehicle as a logistics device—and that is a big premise, that we are, in fact, going to have an expendable launch vehicle with the capabilities required at that time, with a fully automatic rendezvous capability—we do know also that we are going to have to provide a download capability together with the expendable launch vehicle system.

One solution to that is to provide an unmanned reentry capability on the basis of technology similar to, but enhanced from, the Apollo system. We can probably now design a system which would bring back logistics materials from the space station to the ground, fully unmanned, with a guidance capability significantly enhanced from what we were able to do in those days, probably with a parachute landing, although that is not exactly clear at the moment.

Now if we can do that in that timeframe, then that kind of a capability could also be used to return people. What you have to look at is the probability of a problem occurring on the space station at the same time that there is a problem on the shuttle.

When you add those probabilities together you have a very low probability of not being able to visit with the shuttle. But if we do, and we have a regular logistics device, then we could probably use that reentry vehicle as the last piece of the safety numbers in order to make sure you always have a rescue capability.

Mr. NELSON. In an emergency?

Mr. HODGE. In an emergency——

Mr. NELSON. You would not plan to use it because it would be unmanned——

Mr. HODGE. No, no——

Mr. NELSON [continuing]. For logistics purposes, but if you had an emergency, and you had to get people back and you didn't have a shuttle available to go get them, that is what you are saying, you could use that logistics module?

Mr. HODGE. That is right, yes.

So it is an interesting conjunction of two problems which at the same time may together have a single solution to them; and we are examining that right now.

Mr. NELSON. That is interesting. It sort of like the Russians, isn't it, logistics capability?

Mr. HODGE. Yes, it is, as a matter fact.

Now by and large the download capability that the Soviets are using is for people——

Mr. NELSON. What does that mean "download"?

Mr. HODGE. The amount of materials and things that we need to bring from space back to Earth. There is an upload that goes in through the transportation system when we normally use the shuttle to bring——

Mr. NELSON. Taking materials up and taking materials down is what you are talking about?

Mr. HODGE. You are absolutely right; yes.

Mr. NELSON. Talk English, please.

Mr. HODGE. All right.

As we look forward to the period 1993, which is the—the first—in the present schedule, the first flight for starting to erect the space station is in January 1993. We do not yet know how many shuttles will be available to do that, simply because the decision on the size of the shuttle fleet, and the rest of the manifest requirements in that time period are not yet known. At the same time, we do not have the performance of that shuttle at that time.

The other problems associated with doing studies about alternative approaches in the timeframe 1993 and beyond is that even the complementary expendable launch vehicles and the present Titan

34-D-7 segment, their performance requirements are not totally specific for the period 1993 and beyond. So, examination of alternative approaches for mixed fleet, other than for the logistics purposes, is not yet ready, is not yet available for good analytical design implications on the space station.

For that reason, we have continued to assume that the shuttle will be available for the assembly of the space station and that the mixed fleet would be best used at the moment in the logistics and safe haven and rescue part of the program. So in that respect we can only give you some feeling as to what the impacts of the shuttle are in that timeframe.

I have attached in my prepared statement, an estimate of the number of flights required in 1993, 1994, 1995, and 1996, on the basis of the present baseline configuration.

The program has begun to start looking at alternatives to the shuttle for all aspects of the program. We have concentrated for the time being on the question of logistics and safe haven. But as we get more information on the availability of launch and transportation capability in 1993 and beyond, then we will start to examine the impact of that on the assembly of the space station.

I expect that we will have those results from Admiral Truly, from the deliberations with regard to this committee, and the transportation that will be available in those early days, before the end of this year. And, in fact, we will have completed those studies before we bring the contractors on board starting in May of next year.

Thank you for the opportunity; I will be happy to answer questions.

[The prepared statement of Mr. Hodge follows:]

National Aeronautics and
Space Administration

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Presented by Witness

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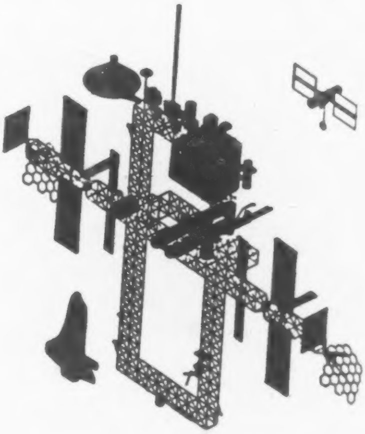
SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS

COMMITTEE ON SCIENCE AND TECHNOLOGY

HOUSE OF REPRESENTATIVES

Statement by:

JOHN D. HODGE
Deputy Associate Administrator
for Space Station



99th Congress

Statement of
John D. Hodge
Deputy Associate Administrator for Space Station
National Aeronautics and Space Station

before the
Subcommittee on Space Science and Applications
Committee on Science and Technology
U.S. House of Representatives

Mr. Chairman and Members of the Subcommittee:

I appreciate the opportunity to discuss with you this afternoon the launch requirements in support of the Space Station Program.

A reliable, safe, efficient, man-rated transportation system will be required to launch and assemble the Space Station as currently envisioned: the manned base and the unmanned platforms. The user communities will require a transportation system which will carry scientific, commercial, and technology experiments and supplies both to and from the Station. Logistics flights will be required to sustain the crew and Station, delivering food, fuel, and equipment to maintain ongoing operations. Crew members composed of scientists and engineers who will conduct activities on board the Station will also require transport to and from the Station. Future flights will also be required to support Station evolution for the launch and assembly of additional modules, structure, and equipment.

One year ago we testified before this Subcommittee on Space Station launch requirements. The estimates we projected were based upon the available data at that time. We also stated that as the Space Transportation System was the Nation's primary launch system, the Shuttle would be the principal transportation system for the Space Station. Indeed, the existence of an efficient, man-rated transportation system is the very basis of the permanently manned Space Station. The Space Station concept from which we derived the current baseline configuration has been totally predicated upon use of the Shuttle as the primary space transportation vehicle to and from the Station. Now however, as a result of the Challenger accident, we are aware that that premise may not continue to be valid. Depending upon the future composition of this Nation's space launch fleet, it could be possible that the Space Station would need to use both the Shuttle and expendable launch vehicles (ELVs) in support of Station needs.

The attached table lists the flights which we presently estimate will be required to support the Space Station based upon the baseline configuration which has resulted from the definition studies and with which we expect to proceed to Phase C/D for design and development. The number of flights shown reflect a further revision to flight estimates that emerged from the systems requirements review this past spring. The revision stems primarily from increased weight of the elements to be launched. A substantial number of flights will be required to launch, assemble, and sustain the configured Station.

Delivery of the Space Station elements, which we believe will take between two to three years to accomplish starting in 1993, is likely to require 20 Shuttle flights. This estimate includes three launches for international elements of the Space Station manned base and four launches for Space Station platforms. This estimate of 20 flights is dependent upon the final design of the Station and the exact nature of the elements that will be provided by our international partners. Seven logistics flights are planned during the first three years with five logistics flights required per year thereafter. Early user payload accommodations are being planned on delivery flights during this initial period although we are assuming a gradual buildup of their activities. We estimate user launch requirements to be five flights in 1995 and six flights in 1996.

As we do not yet know how many Shuttle flights will be available in support of the Space Station or whether we will have a mixed fleet, we submit these estimates for your consideration as to the current program requirements. We have begun studying, and will continue to study, the impact of alternate transportation systems on all aspects of the Space Station Program. At the same time, we are continuing our study of whether or not Shuttle flights will be required to support the advanced technology program prior to launch and assembly of the Station.

Concurrently, the Space Station Program is conducting a safety study for the Station which in addition to further analysis of safe haven requirements includes the assessment of a return vehicle that would always be attached to the Station to be used in the event of a requirement to return the crew to Earth on an emergency basis. It is possible that a requirement for this type of vehicle and logistics vehicle requirements could be combined to minimize the types of vehicles required to support the Station. As the results of these various studies become available, we will modify the Space Station system design as appropriate prior to or at the beginning of the design phase currently scheduled to begin in May 1987.

Mr. Chairman, this concludes my formal statement. At this time I will try to answer any questions you may have.

Current Estimated Space Shuttle Launch Requirements for the Space Station Program*

	Calendar Year		
	1993-94	1995	1996
Delivery**	17	3	-
Logistics***	2	5	5
Users	(2)****	5	6
Totals	19	13	11

* This estimate of possible requirements is based upon the present baseline configuration. As we proceed into Phase C/D, these requirements will become firmly defined.

** This includes delivery of both the manned base and the unmanned platforms. Delivery flights are likely to include some user payloads.

*** A portion of each logistics flight is expected to be cargo for users. User flights may also include logistics supplies.

**** Non-additive. User cargo in the 1993-1994 period will be carried in the logistics flights shown.

Mr. NELSON. OK, thank you all very much.

Now, let's see if we can sort of home in on some specifics.

Mr. Hodge, now I have a number of questions for each of you. Let me just start with you.

Over this past week I have talked to several people at JSC, and they there are some concerns over the space station baseline that you presented to us following your systems requirements review last March, specifically, concerns expressed to me about the number of shuttle flights and the amount of EVA time required for assembly. Now, why are these concerns only surfacing now; just this past week is when I heard about it?

Mr. HODGE. It is not clear to me why they are only surfacing now. They are concerns that have been evidenced over a year or two with regard to the overall program decisions.

The question of EVA is something that has been on the front of the design process as we went through. You will recall that in the middle of last year one of the key questions that we had to ask was whether we would do an automatic erection of the space station or whether we would do it by manual assembly.

As a result of the very, very successful shuttle flights we have had, where, in fact, we did erect a fairly large piece of structure—as a matter of fact, it was one of Dr. Colladay's experiments that allowed us to make this decision—that, in fact, the most optimum way to build the space station was to using EVA and manual construction, it would be significantly less expensive, cheaper and more likely to be successful rather than using automatic deployment.

Our experience with the automatic deployment of systems on spacecraft as a whole, has shown the mechanical devices of that kind are more likely to fail than almost anything else on the spacecraft. So at that time we made that decision.

I would point out that the decision was made as a result of a Space Station Configuration Control Board meeting, everybody in the system at that time presented their views backward and forward, and there are, of course, various views that are presented. The decision was made that that was the best solution to the problem.

Now, one of the key things that came out of that, from my point of view, is that as we began to develop the Space Station Program, we had to make a very fundamental decision about the nature of the extra vehicle mobility unity, the spacesuit, in fact. It has become clear to me over the last several months and, in fact, we already have it baselined in the program as an option, is a brand-new suit, that is much more flexible, has a constant volume, it is easy to maintain and, albeit, I personally believe that we have to provide that kind of capability, a hard suit, in fact, with constant volume, to insure that we do have the maximum level of safety during that period.

Mr. NELSON. I might just give you a little bit of personal experience as an aside here. One of the experiments that I did was the first American stress test in space, in which I ran for 40 minutes on a treadmill. Running on a treadmill in zero gravity is not an easy thing to do.

At the end of that experience I was totally exhausted; I was drenched with perspiration; my crew was telling me that they wanted me to stop after 40 minutes, but I was trying to get a lot of data, I was all wired up, and so on, and so forth. Afterward in comparing with one of the crewmembers, Pinky Nelson, who had done an EVA on the solar max, he was telling me that his exertion was actually even greater than the exertion that I was experiencing under that kind of condition.

So one of the things that is being expressed from the Johnson Space Center is whether or not you have got too much of that EVA that is planned, given the physical limitations.

Now, you talk about a new suit, but how would the new suit actually eliminate that kind of exertion; and how can you ever get a suit in which you have got the dexterity?

It is sort of like you operating out there trying to do delicate maneuvers when, in fact, you feel like you have got boxing gloves on.

Mr. HODGE. Let me say first of all that with regard to continuing examinations of decisions which have been made, we in NASA very much encourage that. The whole purpose of the Space Station Configuration Control Board is continuously to raise these issues as we begin to move the preliminary design phase, No. 1.

I would point out, by the way, that Dr. Owen Garriet, who has experience in EVA, is a scientist in his own right, was the chief scientist at level B, and was also a member of the Space Station Configuration Control Board during this period.

Let me say something about suits. The problem that we have had with suits, really since the very beginning of the manned space flight program is that they were based on soft-suit technology. That was really a derivative from the high altitude/high aircraft interceptor fighter kind of technology.

The problem that we had with them as you move within the suit, the volume of the suit changes so what you are doing is like working inside of a balloon. Every time you change a position you are actually compressing the air within the suit and therefore, putting additional energy into the system.

The question we have been asking ourselves over several years, and this as a result of the technology program which Dr. Colladay has been running at Ames Research Center is: Is it possible for us to build a constant-volume suit, such that no matter what position the suit is in it always retains the same volume, and so, in fact, the only energy required to move the suit was the energy of friction within the joints.

We now have that technology in every respect except one, and that is the question of the gloves. We do not yet have a glove which can be produced—we do have a glove, but one not necessarily that can be produced and be sufficiently reliable to maintain constant volume as you move the fingers.

There is a technology which is now being examined, which is based on bellows, where, in fact, even the finger volumes remain constant within the gloves as you move them. Now, if we can build a suit—and we now believe that we are very close to that—that retains constant volume, then the energy requirements to work within the suit are significantly reduced.

The fact is that with the present shuttle suit the energy requirements for mobility are very little different than they were in the earlier Apollo suits. There is very little change in that because of the soft-suit technology. We believe that we can move a very large direction in that.

Now, let me say another thing about this. We realized very early on in the program that EVA was a very, very important resource, and that we should keep it down to the lowest possible amount, and that, in fact, because there was going to be so much demand on it we should share it very, very carefully amongst the users and the people who wanted to use it for maintenance of the space station itself. In that regard, we have made special effort to look toward automation and robotics to substitute for EVA wherever it was possible.

As you know, we have an aggressive program in that area. Much of the work that we propose to do with the improved RMS, and the robotic end effectors is associated with trading off the cost and the probability of that technology being used in place of EVA.

We are working that problem the whole time during the program. At the present time, there is a significant amount of EVA associated with the construction of the space station. But I believe that by the time we get to the actual period when we will begin to assemble it that the robotics program will have developed to the level that, in fact, much of that can be done without EVA.

That, together with the constant volume suit, which is maintainable on orbit, I think, will begin to alleviate those fears which I see, quite properly, there right now.

Mr. **Nelson**. OK. Now, let me ask you a series of questions and I would like very pointed, direct answers.

Nevertheless, what you have described in the promising technologies with regard to the suit, with regard to the robotics, there have been uncertainties that have surfaced in the question of the space station planning. I want to know you have not—you, collectively you, NASA—has not communicated these uncertainties to this committee?

Mr. **Hodge**. I find it difficult to believe that we have not told you continuously that we are in the middle of a design period——

Mr. **Nelson**. For example, why wasn't the uncertainties about EVA communicated to us?

Mr. **Hodge**. Because we thought we had solutions with regard to the two technologies that we were looking——

Mr. **Nelson**. That you just described?

Mr. **Hodge**. With regard to the suit——

Mr. **Nelson**. And the robotics, that is to be developed?

Mr. **Hodge**. Developed based on——

Mr. **Nelson**. In fairness, so much is still to be developed about the space station; I want to be fair to you.

Mr. **Hodge**. Yes; one of the reasons that we had the extended definition was also to have an extended period of time where we could advance development of the technologies which we knew we were going to need. We wanted to take some of those very good ideas that were coming out of the OAST Program, and enhance those in a matter of time so that we could bring them to bear in time to make decisions about the space station. To give you another example, the question of power, you will remember we have been trying to decide whether we should go totally photovoltaic, or whether go solar dynamic. I talked to you about that 2 years ago when we had the preliminary designs. We have done sufficient work in the advanced development program to know that although that is a difficult thing to do the maturity of the technology is such that we can go ahead with the design with a very low risk. I believe that we have talked to you about these——

Mr. NELSON. Excuse me, let me interrupt you. Are you ready to issue an RFP in October?

Mr. HODGE. I believe we are; yes, sir.

Mr. NELSON. October 1?

Mr. HODGE. I would hate to be tied down to October 1, we have——

Mr. NELSON. Andy Stofan told me last night that you all were headed toward October 15, and he said, no, I want it October 1.

Mr. HODGE. We are going to try to keep the schedule exactly as we have said all along to this committee and everybody else we talked to on October 1. Our present planning schedule has it for October 1.

We have a lot of work to do between now and then, particularly as a result of some of the changes that are made in the work packages, the correctness of those work package RFP's are there at the time that we do. We still have October 1 as our target, and I see no reason why we shouldn't do that within a reasonable time.

Mr. NELSON. Excuse me one second.

Are you, your level B and level C, a now working on a new concept, a new architecture?

Mr. HODGE. No, sir.

The baseline concept is exactly the one that we had, and as a matter of fact, I issued the sort rework of those work packages on—let me see—May 13. That was as a result of all of the level C project managers, the level B people, and the people here in headquarters meeting over a period of about 2 weeks, resolving the issues of overlap, and so on, within the work packages. That solved the majority of the problems.

The last of them were solved as a result of Dr. Fletcher's decisions of a couple of weeks ago, and we are within days of issuing a complete resolution of all work package issues.

The baseline configuration that we have selected is still the program baseline configuration. In connection with this——

Mr. NELSON. OK, let me stop you right there. On that point, the famous Aviation Week article says:

> Johnson Space Center, Marshall Space Flight Center, station Phase B contractors, the shuttle program office, and NASA's advance program staff are all now working on a new station configuration and assembly concepts with the first assessments due August the 1st, and decisions on key station changes due September the 1st.

Is that accurate or not accurate?

Mr. HODGE. It is not accurate from my point of view. The one thing we are working on is a continual examination of the assembly sequence, what we put up first and in what order we build the space station. We have a baseline for that which we think is based on the best knowledge we have to date.

With regard to the baseline configuration, there have been no changes in the baseline configuration. The rate at which you get there and the number of flights you take, may change with time as we go into preliminary design.

But there has been no change in the baseline configuration. To my knowledge, there are no studies going on as a result of the program office, or of moneys which are being spent from our program money which you have supplied.

Mr. NELSON. OK; let me read you another quote:

> John W. Aaron, Acting Space Station Program Manager——

This is a quote, this is a quote from the Aviation Week article——

> Said there is no doubt that changes are required. The problem is determining how to implement them.
>
> A Johnson Space Center astronaut office briefing paper obtained by Aviation Week, reflecting astronaut, mid-level station concerns, said space station programming morale is poor.

You want to comment on those?

Mr. HODGE. I read the article.

Mr. NELSON. What about John Aaron, Space Station Program manager?

Mr. HODGE. I haven't talked to John Aaron since I saw that. I don't know whether he said that or not.

Aviation Week is a respectable document and I am sure they believe that is what he said. I do not know. I have not asked John Aaron that.

With regard to morale, I have not assessed the morale at the Johnson Space Center. I would like to say that with regard to the program as a whole, we have in the last 4 weeks, met at level A, level B, level C, for 2 days every one of those weeks, to reexamine the baseline, to reexamine the work package distribution, and I see no lack of morale whatsoever.

I see a certain level of uncertainty, but we still have a continuing agreement on moving out with the program. I would say that I heard somewhere—I am not quite sure where I read it—that some of those statements were made in order to shock the system.

I would say that it has shocked me. It has shocked me considerably, because we have had several hundred very dedicated people around NASA working for 5 years on this program, as a team, and that in fact, we are moving ahead as a team, and that the morale in the program as a whole is extremely good.

We have every intention to move forward with the RFP's, people are working very hard to do so, and have been doing so for 4 years, and I believe will continue to do so.

Mr. NELSON. Well, the statements made to me on the telephone were not made to shock the system. I might say that the people that I talked to at Johnson I had to pull the information out of.

They were not forthcoming with it in the sense that they wanted to be appropriate in what that said and demur, but they had to answer my questions. I asked them about the EVA. I asked them about the present design. These people were saying that they thought in the best of their judgment that there had to be a reconceptualizing of this dual-keel situation where you would have to have so much EVA because so many of the payloads would be far from the modules.

Mr. HODGE. You will recall that from the very beginning of this program that the single driving factor in building the space station was to make sure that we built something that was needed and could be used. In that regard, for the first year we did our best to avoid configurations, Vu-graph engineering and drawings.

Dr. Donahue will tell you that I spent a great deal of time with his committee specifically seeking those things that were needed that would be useful on the space station, both the manned part of the space station and unmanned. And remember, we are coalescing the manned and unmanned parts of the program in lower Earth orbit in this program.

The design of this space station system, both the coorbiting platforms and the manpower to it, have been driven by the user requirements. And quite, frankly, I am very proud of that fact.

I think you will find that the user communities are very satisfied that we have driven the design not as a device to have fun in, not as a device to challenge our ability to build such a device, but as a useful, permanent facility in space that has multiple functions, that are satisfying the requirements of the users and not merely another piece of the Manned Space Flight Program.

I, quite frankly, do not apologize for that. I believe that it is essential in this program that we drive it toward the requirements of the users.

Mr. NELSON. Are you cranking into your thinking the fact that if a replacement orbiter were to be delayed and so that you have limited, or the present shuttle-lift capability, that you are cranking in how you could put together that assembly sequence with what we have now; you said that in your opening statement, didn't you?

Mr. HODGE. What I have said is that it is possible to look at options on the assembly sequence. We have to know clearly what the performance of the shuttle in that timeframe is in order to do that.

At the present time, for the five or six launches, for example, we were not using the full capability of the shuttle in the performance sense to do that. Many of the launches were dependent on a full capability shuttle.

It is clear as we get more information about the performance capability of the shuttle and the potential performance capability of ELV's in that timeframe, then we should begin to reexamine that effect of that on the assembly sequence. Now, we can break the thing up into smaller pieces if necessary.

Remember the Titan 34-D-7 segment has a lower lift capacity to lower Earth orbit than the shuttle does, even in the sort of potential degraded modes. For example, we have tried, where possible, to take up a fully equipped module.

We certainly couldn't do that—in fact, there was a question of whether we could take up a full module at all on an ELV. And so what we have to do is to look at the impact of the available mixed fleet, which is going to be there when those decision are made.

In the meantime what we can do is look at options. Parametric studies on the basis of potential capabilities, but we certainly can't make program decisions on promises which may or may not occur.

Mr. NELSON. I think that I could speak for this committee and give you a little direction as you pull your design from your concepts, and tell you that the feeling on this committee is that it would like to see you get in place, as soon as possible, parts of a station that could be utilized instead of taking everything up and before it can be utilized, assembling the whole thing. And specifically, on a timetable that is quicker than what you had originally, because I know that was part of your thinking, but a timetable where you take something up, with after two or three shuttle missions taking parts up, you could assemble it and start to use what you have, and then go on down the line in the construction process.

Mr. HODGE. Yes, sir.

Mr. NELSON. Now, do you agree or not that there is dissent in the system about your concept on the space station?

Mr. HODGE. I have read that article. With regard to dissent within the program, we have a very free and open discussion process.

People are allowed to express their views, technical opinions, experienced based, to the largest extent possible. As a matter of fact, they are encouraged to do so.

There will always be differences of opinion. Unfortunately, we have left an impression behind, I think, that engineering is an exact science; it certainly isn't.

By the time you look at, for example, the requirements of the users on the Space Station Program, the potential availability of funds, the introduction of international partners, the potential for commercialization in the space station, you are continually making trades, and there will always be people who are not in 100 percent agreement with the decisions that are made.

We attempt, and we have attempted, I think, in a way that is almost unprecedented in this program to achieve consensus. Nevertheless, there will be people who will disagree.

I would expect that will always continue. The job that we have in the program is to make those judgments where you are walking a narrow line between dissenting opinions.

Mr. NELSON. Let me make some recommendations to you.

The purpose of this hearing is to collect information upon which we can make judgments. We are about ready to start moving out on the authorization for appropriations. We are trying to make the best judgments that we can.

Now, I want to encourage you—I detect that the natives are restless out there in the system. Now whether or not these concerns about the design concepts are valid, I can't judge that at this point. That is one of the reasons for having this opinion; that is part of the reason why I was on the telephone last week, and so forth, and so on.

But one of the things that we have learned from the terrible experience that all of us have gone through is that there has been a lack of communication. And sometimes that communication needed to be enhanced in the hardest of all possible ways of direction for communication to flow, and that is from bottom to top.

So, as we go about trying to sort out what is the best way for us to design this technological marvel, and then build it. We have got to constantly press the system for communications.

Now, my reading of the situation at this point is that there is that concern out there in the system. I think you need to really press it to see——

Mr. Hodge. Yes, sir.

Mr. Nelson. And I want you to come back to this committee on Friday, either you or Mr. Stofan, and give us a report on updated information. We are meeting here at 9:30 on Friday. And you or Mr. Stofan will be first on the agenda.

Mr. Hodge. Let me say, sir, that with regard to this question of communication, both up and down, I could not agree with you more. I think that is absolutely essential in a program of this kind.

Mr. Nelson. OK.

Mr. Hodge. I think it is essential that people express their views. It is also essential in a programmatic sense that we make decisions when we have to.

Mr. Nelson. I understand your problems as a manager, particularly in something that is as revolutionary, as this is. You want to encourage dissent in the system. But your problem as a manager is that you have to manage as well; I understand that.

But I want you to press the system and I want an answer on Friday, because we want to stop having to feel like that we have to get our information by picking up the telephone and calling this or that. We want that system to flow out of headquarters naturally.

We want a constant open line of communications between headquarters and this committee. As you can see, the way I phrase this, I am not making any accusations. I am saying that now of all times we need to press the system for information.

Mr. Hodge. I endorse that.

Mr. Nelson. I will look forward to that report by one or both of your on Friday.

Mr. Hodge. Yes, sir.

Mr. Nelson. Now, I don't want to appear like we are picking on Mr. Hodge, but before I get to everybody else, Mr. Hodge, you are up again. Mr. Andrews has a number of concerns.

So, Mr. Andrews.

Mr. Andrews. Thank you, Mr. Chairman.

Mr. Hodge, tell us, if you will, your relationship to the June 30 decision, was that a recommendation that you made to Dr. Fletcher?

Mr. Hodge. No, sir. It was clear that after the May 13 decisions that we made within the program and that was a consensus decision on the part of all of the project managers, the Level B Program people, and the people at level A, on the appropriate resolution of the work packages with regard to the distribution of work.

Mr. Andrews. How many options were presented to Dr. Fletcher?

Mr. Hodge. I beg your pardon?

Mr. Andrews. How many options were presented to Dr. Fletcher for him to make a decision?

Mr. Hodge. As far as I recall, no options were presented. What were presented to him was the assessment of the committee that he had put together on the basis of resolution of the work packages, and in addition to that——

Mr. **Andrews**. Now, were you in charge of that committee, the chairman of the committee?

Mr. **Hodge**. No, sir. No; it was apparent to me that we had reached the stage where we needed a panel of experts——

Mr. **Andrews**. What was your role?

Mr. **Hodge**. My role was simply to feed information to that group as a part of everybody feeding information. I should, perhaps, talk to you a little bit about the process on that.

General Phillips was charged by Dr. Fletcher to examine management within the agency as a whole, starting with the space station, because decisions had to be made on the space station in order to get RFP's out.

Mr. **Andrews**. How many options did General Phillips present to Dr. Fletcher?

Mr. **Hodge**. General Phillips presented a single set of assessments of the program and the number of recommendations, as a result of listening to—and please, let me tell you what the process was there—General Phillips and his committee spent 2 days with us at headquarters. He spent 4 days at Johnson Space Center.

He spent 2 days at Lewis Research Center; 2 days at the Goddard Space Flight Center, and 1 day at Kennedy, over a period of about 6 weeks, and then spent a week putting together these recommendations.

There were absolutely no conditions whatsoever on the presentations that were given to that committee. I felt that it was essential, as Chairman Nelson has said, that every alternative, and every position was clearly stated to that committee independently of any force measure from any other part of the organization. To my knowledge that took place.

Mr. **Andrews**. Mr. Hodge, I have asked, as you are aware, after the June 30 announcement that the leaders at the Johnson Space Center do an economic evaluation of what your June 30 announcement meant to JSC and to the Houston area; their numbers were pretty stark. They revealed that between 1987 and 1993, in prime contract dollars alone, the Johnson Space Center will lose $1.47 billion, some 1,900 prospective jobs could also be lost in this change. And as a multiplier effect on the business community in the area, 3,000 to 4,000 jobs could be lost in the private sector. The financial loss of your decision on the private business community in the Houston community, we really can't estimate. But I can tell you today that Grumman, that Westinghouse, and I think, Martin Marietta, have all three put on freeze their negotiations with the Houston business community to relocate in Houston as a result of the June 30 announcement.

The June 30 announcement was a tremendously major change in the direction that the space station development was headed. The baseline in April, of who did what percentage of work, is pretty clear. We know that the Johnson Space Center performed 43 percent of the prime contracts in April. And that the Marshall Space Flight Center performed at that time 31 percent.

Your decision totally reverses that role. Marshall will perform 44 percent, and only 29 percent will be performed at JSC.

But really more importantly, and what the Grummans and the Westinghouses all recognize, as do the leaders of the Johnson

Space Center, is that you have taken the development of the manned space systems from JSC and moved it to Marshall. That heart of the space station, where men and women are going to work, experiment, live, and develop the system, you have moved all of that.

I also understand that as of Friday evening, this last Friday evening, the NASA headquarters people here, have reevaluated the work done by JSC, these economic projections, which no one has ever suggested are totally accurate because, frankly, we have had very little information to go on, but what information we do have NASA people have reanalyzed JSC's numbers.

The conclusion, as I understand, was rendered Friday, and JSC numbers are substantially correct; they are correct. The impact on the Houston economy will be devastating, at a time when Texas, of the 11 most populous States, is No. 1 in unemployment, you have made a decision that will have far reaching and devastating economic impact on one State and one city in particular.

I understand that you made no economic analysis of this impact prior to the final decision being made; is that correct?

Mr. HODGE. With regard to the specifics of the total amount of dollars, we are talking about the total amount of dollars that would reside in the Houston area——

Mr. ANDREWS. Now, Mr. Hodge, we don't have a lot of time today. What I would like you to do is if you could just answer my questions.

Did you do an economic impact study of the consequences and effect of your decision?

Now, Dr. Fletcher has said to Chairman Nelson and myself, that none was done; is that correct?

Mr. HODGE. I have to understand what you mean by an economic analysis. The one thing we did realize was that as a result of the management decision, to centralize the management in headquarters, here in the Washington area, that the level B function would be transferred from the Houston area to here in Washington.

Mr. ANDREWS. That is not my question.

The question is, Did you do an economic impact study; did you try to determine in the broadest sense what kind of economic decision this decision would have on the community of Houston?

Mr. HODGE. As I said, sir, the one we did look at was the implication of the movement of the number of people which would be resident in the Houston area in order to move the level B function.

Mr. ANDREWS. Now, when Dr. Fletcher last week met with Senator Gramm, he had not had at that time the opportunity to study the analysis that was prepared at JSC, that has been his statement to the press—you are aware that—but he hadn't had a chance to look at it.

Also, when he met with Senator Gramm, he had not at that time seen the NASA analysis that confirmed these statistics. That is correct; because this analysis was just done Friday evening. That is correct, isn't it?

Mr. HODGE. That is not yet complete to the level of detail that we would like to have.

Mr. ANDREWS. That is part of the problem, Mr. Hodge. No in-depth economic study was done prior to this decision being made. A decision that really changes the leadership role in the development of the space station for generations to come.

Mr. Hodge. With regard to one particular statement you made, sir, I would like to modify somewhat.

The whole EVA question, which is a large part of the Manned Space Flight Program, the data management system that goes along with that is still retained in the Johnson work package. With regard to the habitability module, where the drive there was to insure accountability of the end item deliverable on the part of the contractor, the technical direction of the habitability module will be retained at the Johnson Space Center in conjunction with the program management at Marshall Space Flight Center.

Mr. Andrews. Well, there is no question that JSC is going to continue to do work on the space station, we will just go from 43 to 29 percent of the work; no question that we are going to do some work. I am not suggesting that there won't be jobs created in Houston as a result of your decision, or that Johnson won't play a part.

Your decision just removes JSC as the lead center in development of the space station; that is what it does, doesn't it, Mr. Hodge?

Mr. Hodge. That is true.

Mr. Andrews. I want to be real clear because there was some confusion last week about job loss or job gain as a result of your decision, and what I want to be clear about, is Dr. Fletcher not only did not have the benefit of having an opportunity to study the JSC evaluation that was prepared at the very highest level at the Johnson Space Center, nor did he have the benefit of the analysis of that study that was prepared just last week by the people here at NASA and completed Friday evening.

Mr. Hodge. It is not yet completed, sir.

Mr. Andrews. Well, as of Friday evening they know enough now to be able to say that the JSC figures are essentially correct; do you know that?

Mr. Hodge. What I do know is that 50 percent of the program decisions have yet to be made with regard to that specific move of the lead center function to headquarters. I will say that that decision was made on the basis of some very, very strong recommendations that were made by the Rogers Commission with regard to the centralization of control of programs within NASA.

Mr. Andrews. One of the other things the Rogers Commission concluded was that NASA should in the future should communicate more, that is what the chairman was speaking to earlier today.

Mr. Hodge. Yes, sir.

Mr. Andrews. Not one Member of this Congress, not one member of this committee was consulted with about this June 30 announcement. My office received a notification that there would be a press conference 20 minutes before you made the announcement to change the direction of the Space Station Program, 20 minutes.

Not one Member of Congress was consulted, not by Dr. Fletcher, not by you, not by any of your associates who are sitting here today.

You know there has been a long, hard tradition in this Congress of cooperating with NASA. No one has been more cooperative than our chairman, Bill Nelson, or Don Fuqua, the chairman of the full committee, or members of this subcommittee.

This is a tremendously major departure without even so much as a phone call to the chairman of the appropriate committees. And as a result of that, a meeting was held with Chairman Nelson, and myself and Dr. Fletcher last week. We handed him a letter in that meeting in which Bill Nelson signed, as well as Bob Walker, the ranking minority member; are you familiar with that letter?

Mr. HODGE. Yes, sir, I have a copy.

Mr. ANDREWS. That letter suggests and requests that you stop, you stop implementation of your proposed changes until Congress has been fully consulted with; do you appreciate what that means?

Mr. HODGE. Yes, sir.

Mr. ANDREWS. Then why did you testify a few moments ago that within days you anticipate a complete resolution of the work package changes?

Mr. HODGE. I expect as a result of communications at level C, level B, and level A, to have a set of data which will allow us to resolve those issues, the work package issues.

I think what you are talking about——

Mr. ANDREWS. Well, when do you plan to come to Congress and talk to us about these changes, before you reach your conclusions, or after you reach your conclusions?

Mr. HODGE. I gather from Chairman Nelson that he has asked me to talk to him about that on Friday morning.

Mr. NELSON. Let's don't get those mixed up.

He is talking about a different issue. We are talking about the concept for the design of the space station, which I have asked you to come to on Friday.

Mr. Andrews is talking about the Houston versus Huntsville issue, which is a different issue.

Mr. ANDREWS. Now, you should be advised that in addition to the letter that we gave Dr. Fletcher, I have written today to the Comptroller General of the General Accounting Office and requested that they do a full study of the cost that this change will incur to the Federal Government. I would hope that you would participate and supply them with whatever information the GAO needs to try to determine what the cost of your change will be.

Mr. HODGE. We will be very happy to work with them.

Mr. ANDREWS. Our committee has not received the appropriate information from you, Mr. Hodge. We have not been able to assess the June 30 decision.

Dr. Fletcher agreed in our meeting last Tuesday morning that from that point forward the committee would receive information from NASA in order for us as a Congress, as a staff, to draw some evaluations about what the consequences, what the significance of some of these changes are; you are aware of that?

Mr. HODGE. Yes, sir.

Mr. ANDREWS. Finally, we are going to have a remarkup this week—next week, I intend to request that the committee put report language in the bill that insists that you stop the implementation of this change until we have fully been consulted with.

Did you talk to the astronaut corps about this change prior making these decisions?

Mr. **Hodge**. The particular decision with regard to lead center, or with regard to modifications in the work package?

Mr. **Andrews**. Both; the June 30 announcement.

Mr. **Hodge**. The astronaut corps have been participating in the program from the beginning. As I mentioned earlier, the chief scientist at level B, is an astronaut of impeccable qualifications both to the scientific community and his experience in manned space flight associated with things that are similar to the space station, namely, the skylab and spacelab, he was a member of the Space Station Configuration Control Board.

I have myself, over the past 4 years, made many presentations to the astronaut corps, visited Houston to explain to them what we were doing. I am not quite sure how we could have done more in that respect.

Mr. **Andrews**. You are confident then that you have taken all of their considerations into account in making this decision.

Mr. **Hodge**. I think that we have listened very carefully to what their concerns were, and done the best we could to ameliorate those situations; yes.

Mr. **Andrews**. Is it true that you intend to have a study done on whether or not to move part of the astronaut corps to the Marshall Space Flight Center?

Mr. **Hodge**. Not to my knowledge; I certainly——

Mr. **Andrews**. You have not initiated any study?

Mr. **Hodge**. No, sir.

Mr. **Andrews**. You don't intend to initiate any study to move those astronauts that will be working with station to Alabama?

Mr. **Hodge**. No, sir. I have talked to Mr. Stofan with regard to an increase in the participation on the part of crew at the program, at all levels.

Mr. **Andrews**. Well, that is what I am talking about. I am talking about do you intend to create an astronaut corps to deal with the station?

Mr. **Hodge**. It is not clear to me yet whether that astronaut corps is exactly the same one as we presently have or a different one. We have to consider the international participation, for example, I personally see no change in the general concept that the manned space flight resides in experience and capability largely at the Johnson Space Center and, in fact, they will have technical direction over those parts of the programs associated with that.

Mr. **Andrews**. So, do you intend, then, to create a new and separate astronaut corps to deal with station?

Mr. **Hodge**. Not in the way that you are saying. What I want is the astronaut corps to participate in the decision-making process to a level that is appropriate. I would like to see more than we have had to date——

Mr. **Andrews**. That is what I am talking about. Let's assume we increase the corps from the approximate 100, do you intend to create a separate astronaut corps to work with Space Station and have them located at the Marshall Space Flight Center in Alabama?

Mr. **Hodge**. No, sir.

Mr. **Andrews**. Have you asked that a study be done?

Mr. **Hodge**. I have not done that.

Mr. **Andrews**. And do not intend to?

Mr. **Hodge**. No, sir.

I have no doubt that the astronaut corps presently existing at Johnson will participate in the design process that takes placed in the Space Station, and some of those activities will take place at Marshall, and they will participate in those Space Station design decisions; I am absolutely confident of that. I doubt very much if they will end up being resident there.

Mr. **Andrews**. I am sorry?

Mr. **Hodge**. I doubt very much if any of the crew will be resident at Marshall. They will remain resident where they are now, participating in the program wherever it occurs. As in fact they have done over the last 25 years.

Mr. **Andrews**. You understand the reason I am asking this is because is that the tradition at the Johnson Space Center is that we are the manned center. That is where manned systems are located. And to move part of that away is to really once again pull the heart out of that center; would you agree with that?

Mr. **Hodge**. Believe me, sir, I understand that, since I joined the space task group at Langley Research Center in 1959, the same week that the first seven astronauts did, and I participated in building the Johnson Space Center for the first 12 years of that center.

Mr. **Andrews**. Do you have any intent, or are you studying any thought to move the flight operations of the Space Station to Huntsville?

Mr. **Hodge**. We haven't made any decisions at all on the total description of what flight operations is. We have had for the last year and half a working group, an operations working group, with participation from all of the centers, particularly from Johnson and Kennedy, and from the Goddard Space Flight Center since in this program we are amalgamating the manned and the unmanned programs. With regard to the specific facilities that are required, we presently have in our preparations for the 1988 budget, requirements for facilities at most of the centers. With regard to whether we have a central control system or a distributed control system, that is a subject for discussion with regard to the overall operational concept. As you can imagine with international participation, those people are requiring control centers of their own for their own pieces, and not unreasonably when they ask that.

We have to look at the——

Mr. **Andrews**. So the is the possibility that you are contemplating that would have part of the flight operations not at the Johnson Space Center but at the Marshall Space Flight Center——

Mr. **Hodge**. Which is, in fact, the way things are right now, as you know.

Mr. **Andrews**. Well, Mr. Hodge, we are talking about the main control of station.

Mr. **Hodge**. I see the main control of the station, especially during the assembly phase, being identical to the way that we have run programs for the last 25 years.

Mr. **Andrews**. In your testimony today that you have not asked for two studies to be done to review both of these problems in the astronaut corps in Alabama, in moving the operations, the main operations of Space Station to Alabama; is that your testimony?

Mr. **Hodge**. Absolutely. I don't know where that came from. I certainly have not said anything of that kind and I have not directed anybody to do that.

Mr. **Andrews**. Pass the witness.

Mr. **Nelson**. OK, thank you, Mr. Andrews.

Let me just end up, and we will follow up, Mr. Hodge, on Friday, back on the question of design and how that affects our assured access to space.

My eye was caught by this Aviation Week article, by this statement, "NASA has initiated a study of a large, new unmanned booster for launch of station elements as a result of these concerns." You go on, they are expressing concern about whether or not you could get up the whole station with shuttle since shuttle has to do so many other things, including all of the backlogs, and so forth. Tell me about—first of all is that a true statement, initiated a study of a large, new unmanned booster for launch of station elements?

Mr. **Hodge**. I would characterize it as being for launch of Space Station elements. There have been ongoing studies, long-range studies, with regard to future transportation systems which have included heavy-lift launch vehicles. To my knowledge, they are simply studies. No decisions have been made to the character of those or when they would be available. In the study bases that we have been using for the development of the Space Station, we had no choice but to assume that the availability of transportation in the early 1990's at first would be solely shuttle, and now, of course, may contain other elements of expendable launch vehicles. With regard to decisions on heavy-lift launch vehicles, to my knowledge, they have been studied since the early Saturn days, and they have always been studied, and they continue to be studied. But I know of no decisions that have been made of that kind whatsoever. That is a very heavy development program, I believe, if it were decided to go that way.

Mr. **Nelson**. My question is did NASA initiate recently a study of a large new unmanned booster for launch of station elements.

Mr. **Hodge**. The Space Station program office certainly didn't; there may be such studies going on.

Mr. **Nelson**. When did you start your planning with regard to this logistics ELV?

Mr. **Hodge**. I can't remember the exact date; it was within about 6 weeks of the Challenger accident, that we directed the engineering groups to begin to look at the implications of that accident, particularly with regard to safety and with regard to logistics. We felt that it was prudent for us to examine alternatives even before the whole concept of a mixed fleet came out.

That is a fairly difficult study to do from an engineering standpoint. And as I say, we expect the preliminary results of that sometime during August.

Mr. **Nelson**. Would you on Friday, if it is possible, try to have Mr. Stofan here with you?

Mr. HODGE. Yes, sir.

Mr. NELSON. I would appreciate it. I know he is new on the block but it is important.

Now, on the logistics ELV, when were you planning to tell us about this logistics ELV?

Mr. HODGE. With regard to the results of the study?

Mr. NELSON. The fact that you, in fact, had a study.

Mr. HODGE. I have talked about that study. As a matter of fact, we talked about it at an appropriations hearing, so when I discussed it with you before—I have talked to your staff about it, and I will be happy to bring them up to date on the present results when the final report comes in from Houston.

Mr. NELSON. All right.

Mr. HODGE. Excuse me; I think the announcement of that study was made in front of Chairman Boland of the Appropriations Committee; we started it off with your hearings.

Mr. NELSON. Mr. Sade, you have been there mighty quiet representing Dr. Banks. Let me ask you a couple of questions here.

Dr. Banks mentioned in his statement that the potential exists that the gap between our own science capabilities and those of the Soviets may become wider; how serious do you think that this gap is now; answer that and then we can go on from there?

Mr. SADE. Well, Dr. Banks, from the day that he has been presented, sees approximately an 8-year gap. And from that data, he has suggested that we press on with the Space Station on the current schedule.

Mr. NELSON. An 8-year gap; is that right?

Mr. SADE. Yes, sir. That is Dr. Banks assessment, yes, sir.

Mr. NELSON. All right, given that, is it more important to accelerate our space station to close this gap or to delay this program, our program, so that we would have more certainty in the baseline configuration.

Mr. SADE. Let me preface what I am sure Dr. Banks would say by first describing to you a process that the committee has engaged in. They have had briefings by most of the elements of Space Station management and certainly by Dr. Edelson, the user community, even to the extent in some cases looking at the commercial and international participation.

Having set that stage, Dr. Banks, and the task force membership is really aware, I think, at about a level 2, what the Space Station planning schedule is. I doubt seriously, Mr. Chairman, that he would call for an acceleration, because I don't believe he has been presented an alternative that said there was a possible acceleration.

But he certainly, in his written testimony, and I know verbally, and again in his testimony, has encouraged that we stay on the current schedule so that meaningful science can be conducted in the early 1990's at the IOC period.

Mr. NELSON. Describe to me the 8-year gap in your and Dr. Banks' estimate that we are behind.

Mr. SADE. Well, he picked that number from the fact the Soviets have put their program in space, he had a presentation given to him and the task force. He certainly, as I indicated earlier, has the Space Station schedule, which gets us now into a 1993 first-element launch. If you look at the science of an approximate period of 2 or 3 years getting to a full up IOC, if you will, from a science point of view, and you can derive the approximate 8-year gap.

Now, that, Mr. Chairman, is on a facility that is long duration, that is in space for years. He thinks in terms of our Space Station and competition with the Space Station as described by the Soviets.

Mr. NELSON. Now share with me what your thinking is of how you measure that gap, you are looking at 8 years. I take it you are looking from 1986 to 1994, that is where you get the 8 years?

Mr. SADE. Yes, sir.

Mr. NELSON. Now are you saying that their capabilities in this present year of 1986 are the same as will be the capabilities we will have in 1994 and, therefore, that is where we have the 8-year gap; we are talking about science now as a result of the station; is that correct?

Mr. SADE. That is correct. In the presentation that I participated in and the task force membership did, we didn't look—we were weren't really exposed to the science and the USSR capability.

But if you would look at an apples and apples comparison, if you would see an initial capability in orbit in 1986 for the Russians, and you would look at an initial capability in 1993/1994 for the United States, just at that level you could derive an 8-year gap. It is intended, and as you, Mr. Chairman, have so aptly put it today, that we want science very early in the elements going up to space station as early as the fourth or fifth launch.

I believe in all fairness to Dr. Banks and the commentary, and his prepared statement, that he is looking at science in 1986 for the Russians on a comparable basis for science in the United States. He also, in that presentation, I should add, understood that the initial capability in the U.S. space station exceeded that which we understand the USSR to have today.

Mr. NELSON. Dr. Edelson.

Dr. EDELSON. Perhaps a few words on several niceties of evaluation would be helpful here. I think it is misleading to give a single figure, such as 8 years, for the state of science in one country versus the other. It is different in different disciplines and then it is important whether you are talking about the number of missions or the experience, the technology, such as the development of scientific instruments and also scientific knowledge that you can quickly see.

For example, the Russians have yet to do an important mission in space astrophysics, astronomy or physics. Also they have not had a program in earth-oriented science. In the space station context, however, it is fair to point out that they have had a lot more flight experience in manned space flight and therefore have a lot more experience and accumulated knowledge in life sciences, adaptation of humans to the space environment and animal research in space, which they have had underway continuously over the past years and have, in fact, in progress right now.

And second, because they have had space flight, they are making progress in materials processes in space. I think it is fair to say that in life science they are ahead by a decade of experience or so.

So 8 years is a reasonable statement for that. That is in terms of data and experience, not necessarily in understanding of the science, which, of course, is passed around the world. They have been extremely generous in sharing their life science data with us.

In material science, they have the opportunity, which they will be exploiting for the next 8 years, certainly, and it will probably be that long before we get enough experience on the shuttle and then on the Space Station to say that we have had as much experience as they have.

The other area is planetary research, which is not under question right now, but I think that it is clear that they have been a lot more active in that and had a lot more missions then we have and therefore they have had the opportunity to do things that we haven't had to do, yet we are aware of the fact that our development of scientific instruments is considerably ahead of theirs, and that our technology is much more sophisticated than theirs. Yet they have got the missions and they are accumulating the data.

That is a long answer, and it is a multifaceted problem. I think the specific point that Peter Banks was referring to in which the space station will make all the difference in the world to our program is in the manned flight research in the modules on the space station.

Mr. NELSON. I must say that it does concern me that with their present station the Mir, of having the capability of materials processing, 24 hours a day, 365 days a year, and we can't even get back into space and start with materials processing until 1988, and then only on bits and snatches of when we can get up for a few days. Needless to say that most of us feel in this room today, that there is an extraordinary future of materials processing and that delay really does concern me.

Mr. Sade, let me ask you this. The task force which Dr. Banks chairs, is there a follow-on task force that has now been organized, and describe how it is going to be functioning?

Mr. SADE. Doctor Edelson, and John Hodge have discussed the follow-on to the task force, as you understand. It has been agreed that there would be a follow-on task force. Generally speaking, the task force would have all disciplines represented.

It is intended that the more recent membership would follow on that component of membership that has been in place for 2 years would then be up for renewal. But the basic charter would be then look at the follow-on work to be concluded in Phase B, and then the new work to be picked up in the Phase C/D.

Mr. NELSON. OK, we want to encourage that, and as you know in the markup of the NASA authorization bill a couple of months ago, we called for the establishment of a follow-on task force.

Mr. SADE. Yes.

Mr. NELSON. OK, Doctor Colladay, you mentioned three major program areas in your testimony that you are planning, behavior of structures, management of fluids and aerobraking. Tell us what are the shuttle requirements for these, how many flights, how much payload space?

Dr. COLLADAY. Generally, those experiments require a pallet size in the payload bay to control a flexible structures series of experiments starting with a mast and then a three-dimensional figure like an antenna, and then a distributed mass system would like to fly about once a year, starting as early as 1991. There is a ground-base program companion to it in that for every test article that is flown, you do ground-base testing to correlate those facilities with the flight data so it is an integral program to the ground and flight.

The cryogenic fluid management experiment also is pallet size and I envision several flights of that on about 1 year interval, again, starting in the early 1990's.

The aerobrake flight experiment is not an approved program, we have gone through a program definition and, in the time schedule that we have that laid out, the first flight experiment again would be in the early 1990's, and I would expect at least one reflight in order to explore the full parameter space of the test program.

So, in each of those about pallet size, the aero assist flight experiment is about a third of the shuttle bay. In no case do we take an entire orbiter, we go piggybacked on other flights either for science or other flight experiments.

Mr. NELSON. OK, you want to describe for us what would be the impact of delaying these missions?

Dr. COLLADAY. In the technology experiments that we have planned it is very hard to say that there is schedule-critical timing involved. It means just delaying the technology-based development, the understanding of being able to work with and build complex hardware in space.

For example, a control of flexible structures experiment is desirable but not necessary as a precursor to IOC space station. It is, I would say, on a critical path to evolutionary station, as you play different masses on an expanding station structure, but not for the IOC station. It is in the category of "like to have that data" in order to confirm our ground-base scale model testing.

In the case of the aerobrake experiment, if that is the concept we choose for the OTV development, which in our opinion, it is the correct concept, then that flight experiment would be necessary before we could do a design and development of a space-based orbital transfer vehicle.

Similarly, the cryogenic fluid management is required before one would space base an orbital transfer vehicle because it would be based at station and refueled there.

Mr. NELSON. Tell us about transfer fluids in orbit, or satellite refueling, cryogenic replacement, what do we need to do to fly to achieve this operational capability?

Dr. COLLADAY. The fluid management experiment, as it is defined, would give us the data necessary to design the tankage, the insulation, and the transfer mechanism, required to take fluid from the tank and transfer it into satellite for on-station, or on-site in situ servicing. We don't know how to do that.

There are a number of ways one could devise a system for the transfer of fluids, but we don't even know what the best way is to design a system to make sure that the fluids are in the tank where we expect them to be, near the exit location. So, we need that flight experiment in order to get the data on transferring those fluids.

There is no way to simulate that on the ground. We can't approximate it by any ground-base simulation.

Mr. NELSON. Dr. Smith.

Mr. **Smith**. Yes, I just wanted to get a feeling for the general scenario for satellite servicing, perhaps, on the station or in situ, how much does that depend on the data base you would collect in this series of fluid management experiments?

Dr. **Colladay**. Small amounts of fluids in bladder containers to service satellites is probably doable without a flight experiment. Fueling orbital transfer vehicles, where large amounts of fuel would be required for a vehicle, gets into the realm we don't understand and would have to have this flight experiment.

I wouldn't think it is a precursor for satellite servicing as a requirement before we could do, small amounts of fluid.

Mr. **Nelson**. You want to give us some of your comments about a heavy lift ELV?

Dr. **Colladay**. Well, we have looked at it from time-to-time, Mr. Chairman, in different configurations as part of general studies, and what technology would be required to develop such vehicles. It is also part of the NSSD studies that you are aware of that we are doing jointly with the Air Force, looking at a family of launch vehicles, of which that is one under consideration, and the backing out the technology that might be required to develop such capability.

There are a number of technologies that we know we have to work for an optimum configuration, one is transferring the understanding that we have in LOX hydrogen, high energy stages to LOX hydrocarbon, with the higher density fuels that you would like to have with a heavy lift launch vehicle. That gets into heat transfer and associated materials problems one encounters with hydrocarbon based fuels.

We are looking at a number of those in the advanced technology program in OAST.

Mr. **Nelson**. Tell me about the atomic oxygen problem?

Dr. **Colladay**. Well, we recognized very early in some of the shuttle flights that we were losing coating integrity on certain coatings. We put specimens of materials and various coatings on a tray and flew them in the payload bay, exposed them at various orientations of the shuttle.

What we suspected early on is atomic oxygen attacking the coatings. We have, through the development of that data base, have developed coatings that are resistant to the erosion caused by atomic oxygen.

At the altitude that the orbiter flies, there is a substantial concentration of oxygen in atomic form that reacts with these various coatings. Some coatings are more immune to that than others, and through the development of that data base, we identified appropriate coatings.

Mr. **Nelson**. Well, is this going to give us a problem in launching the space telescope?

Dr. **Colladay**. No, sir, we have worked that and understand the mechanisms. I don't expect that it will be a problem.

Mr. **Nelson**. Doctor Edelson, are you planning flight readiness, a specific date for flight readiness for ACTS in 1990?

Dr. **Edelson**. As you know, Mr. Chairman, we were previously planning 1989. Depending upon the level that we end up with with 1987 funding, if it is reduced from the amount that we requested, we will slip that launch date into 1990 or 1991, based upon funding.

Mr. **Nelson**. Go ahead, Dr. Smith.

Dr. **Smith**. The nature of the ACTS question, I guess, relates to a lot of the other science programs and given the tone of this hearing, payload priorities, I think a general question is are these programs, your funding profiles, being predicated on assigned launch dates as opposed to their technical maturity and natural technical progress. Or have we made a transition as a result of this diminished access to space?

I think ACTS is one question. Are we still planning in the administrative process through the procurements and the other apparatus, are we planning for flight readiness in 1990 or some other assumed flight date?

Dr. **Edelson**. To answer your question properly, we have prioritized our missions. First is to get off those missions which are ready and which were caught in the delay now.

A No. 1 example is the Hubble Space Telescope; it is top on our list. And then there are others which were ready to go like the Astro-Halley flight. It won't go after Halley, but is the same Astro configuration, it is ready to go, the hardware is all ready, and we put that up there ahead of others which we haven't completed the hardware yet.

It is hard to answer the questions in general, because many of our high priority missions, such as the planetary ones, have to slip, not because of lack of priority or technological readiness, but because of the particular launch vehicle configuration slips.

I am afraid I can't give you any general answer to that question. We don't, as you know, have a manifest. We are getting close to agreement on a manifest with the 18-month downtime.

Now we are starting all over again on the 24-month down-time, and that situation is not at all clear.

Dr. **Smith**. I just wanted to make clear that we want to avoid delaying procurements based upon the influence of flight rates, if, in fact, it results in inefficient funding profiles, program stretch-outs, and cost overruns, we don't want this to become a self-fulfilling prophesy, if you will, for flight delays.

Dr. **Edelson**. Yes. To make it clear what we are doing, we have now agreed that we will use a 24-month downtime. That means a resumption of launch in February 1988—excuse me—and with a launch of about six in the first 12 months, and I think it is nine in the next 12 months, and so on.

We were using about one-third of the shuttle capacity before the accident. So we would like to count on getting a third of the shuttle capacity when we start up again.

Not only that, we would like to hit our particular window and launch opportunities that we have. Even so, we are faced—and even if we get all of that, we are facing enormous delays so that some of our missions will slip 5, 6, and 7 years. We have not yet, but the budget process is forcing us to decide which missions to stand-down on for several years and/or cancel.

We have already canceled two missions just because they were overtaken by events. I am sure that we will have to cancel many missions.

Simply, as much as it hurts, it simply doesn't pay to keep groups of people standing around for 5 years or longer when that funding could be more productively employed in the meantime.

Mr. NELSON. You mentioned Delta vehicles, do you have any assurance that DOD will release your option on Delta vehicles as they did on the Indonesia satellite?

Dr. EDELSON. No; no assurance at all, in fact, a number a statements that they would be reluctant to do so. But the planning that we are doing is going ahead on the assumption that we will have the availability of vehicles when the time comes.

Mr. NELSON. And which missions would you use the Delta vehicle for?

Dr. EDELSON. I mention the Delta in this case for the possibility that if one would come available we would get a quick flight opportunity for an explorer-class mission, and we would assemble such a mission with opportunities that we have.

For example, I mention that the idea is to possibly launch a converted Spartan vehicle, with different types of either Earth observation or space plasma physics payloads.

Mr. NELSON. Are the spacelab flights you are now planning within the shuttle performance capabilities, are they within that, or will you have to have waivers on the weight?

Dr. EDELSON. We are in great difficulty in that question. First of all, the shuttle performance capability is coming down as new engineering changes are made to account for safety, in the lift capability and in the landing weight.

We have a preference for the use of *Columbia* because of its extended stay time in orbit for certain missions, particularly materials processing and life science. But *Columbia* is 6,000 pounds or so heavier than the others and so we have a downweight capability, I believe the limit was 214,000 pounds landing at Edwards. If anything, that limitation for safety reasons is going to go down and put us into a more difficult situation.

Just to give you a feeling for the situation, of the 210,000 or 215,000 pounds that goes down, about 35,000 pounds represents the space lab module and supporting structure, and only about 4,000 represents the scientific instruments that we fly in the spacelab.

Well, our margin is about 4,000; we are about 4,000 too heavy to land. So the situation is how can you limit the weight, and if we take off all the scientific instruments we don't have any payload left.

Mr. NELSON. What other payloads would you have to have waivers on?

Dr. EDELSON. We have almost every spacecraft—every launch opportunity that we have now has to be reexamined. There is, for example, on UARS an instrument called CLAES, an atmospheric science instrument that has a solid hydrogen cryogenic refrigerator on it.

The shuttle *Centaur* decision would lead to believe that we are not allowed to fly cryogens on the shuttle, so we would either have to get a waiver for that or take that instrument off which would seriously harm the science, or find a way to launch it on an expendable launch vehicle.

The UARS spacecraft is rather a spindly design, ideally designed to launch on the shuttle, and is not easily amenable to being packaged for launch on an expendable launch vehicle. We have got problems like that in almost every area, and until the safety considerations settle down and we have a set of criteria that we can work with, we are in trouble on all of these launches, including the Hubble Telescope where we have lots of new design changes, new hardware changes that we are requested to put on in order to make it safe to fly on the shuttle.

Mr. NELSON. By you having hardly any margin, that is not a definitive answer, it is a speculative answer on your part, on *Columbia,* with spacelab, I take it implicit in your answer is the fact that you can't shift to one of those other two orbiters because of their need to launch other payloads?

Dr. EDELSON. Yes, sir, the high performance orbiters, the *Discovery* and *Atlantis* are in great demand for the high performance flights, particularly the military launches. There are more *Columbia's* available, so we have that particular problem.

Mr. NELSON. Dr. Smith, you have got a couple of questions.

Dr. SMITH. Thank you.

On SLS-1, the first spacelab dedicated to life sciences, do you recall what the first manifest date was at inception, when would the first flight of SLS-1 have been, if everything had gone well?

Dr. EDELSON. March 1987.

Dr. SMITH. March 1987?

What is the latest manifest date that you are aware of, just ballspark figure, recognizing that it is not a commitment?

Dr. EDELSON. The second quarter of 1989 is our worst-case scenario. And we are shooting now for the third quarter of 1988.

Dr. SMITH. The third quarter of 1988 for SLS-1.

Dr. EDELSON. Yes, sir.

Dr. SMITH. In the case——

Dr. EDELSON. It is hard to answer the questions the way I know you are going to ask them now.

We have looked through our missions and we have tried to figure out what are our most important missions, and of the spacelab's we have identified SLS-1, IML-1, Atlas-1, which is the old EOM; and Astro-1, as the four priority missions.

What I am trying to do is work those in in that order as early as I possibly can into the mission. It looks like SLS-1 is ahead of the list. It looks like the third quarter of 1988 is the earliest possible chance to launch.

Dr. SMITH. That is your priority list, not necessarily the agency's final manifest or agency's position?

Dr. EDELSON. That is correct. If you honor the military priorities, and slip all the rest accordingly, it comes out with a manifest that isn't nearly that good, and even these dates which I just cited, are troublesome to the scientific community.

Dr. SMITH. You mention the cost and other impacts of keeping these scientific research teams together for these delayed missions. In a case like SLS-1 do you have a sense of how many investigators are involved and a ballpark figure what the cost is of a mission delay in a case like, supporting the principal investigators?

Dr. EDELSON. I will supply that Dr. Smith; I have all those numbers worked out.

Would you care to ask me about another mission that is not the one I——

Dr. SMITH. Well, I think we are going to ask a summary question, I know that you do have those numbers. What we would like for the record is a summary of all of these spacelab related missions, the number of investigators that are associated with these, the percent readiness as of January 1986, and the cost of the delay per month?

Dr. EDELSON. Yes, I have all that information; I will supply it very shortly.

Mr. SMITH. And if you would, also your target manifest date for those missions?

Dr. EDELSON. All right.

[The information follows:]

Enclosed is a tabulation of the OSSA Attached Shuttle Payloads with information relating to the number of science investigators, state of readiness (as of January 1986), old and projected launch dates, and the approximate near-term slip-costs.

ATTACHED SHUTTLE PAYLOADS—OFFICE OF SPACE SCIENCE AND APPLICATIONS

Mission[1]	Science investigators[2]	CO-I	Readiness[3] (January 1, 1986) (percent)	Launch date		Approximate delay cost (thousands of dollars per month)[5]	Notes
	PI			January 1, 1986	Projected[4]		
Astro-1	3	11	100	March 1986	3Q/89	415	(6)
Astro-2	3	11	70	January 1987	3Q/93		(7)
Astro-3	3	11	50	August 1987	TBD		(7)
Sheal-1	1	1	75	January 1987	TBD		(8)
Sheal-2	2	5	35	October 1988	3Q/92	415	
Sheal-3	2	4	5	1991	TBD	50	(9)
WAMDII	1	4	25	May 1989	2Q/93	50	(10)
Sunlab	4	17	40	October 1988	TBD	120	(11)
Darksky	3	7	40	October 1988	TBD	100	(12)
SPL-1	5	35	10	December 1990	4Q/93	360	(13)
SPL-2	6	42	0	December 1992	TBD		(14)
Atlas-1	14	44	85	August 1986	2Q/91	250	(15)
Atlas-2	11	23	0	November 1988	4Q/92	0	(16)
SRL-1	2	55	65	March 1987	3Q/93	60	(17)
SLS-1	20	22	80	March 1987	2Q/89	300	(18)
SLS-2	18	26	60	July 1988	3Q/91		(19)
SL-J	3	6	40	February 1988	1988	75	(20)
IML-1	29	123	70	May 1987	1Q/91	75	(21)
MSL-3	3	7	75	November 1986	3Q/88	125	(22)

(1) Major missions planned effective January 1986.

(2) The number of investigators is approximate. Near-term missions are well defined but for some missions the final scientific complement has not been selected. Coinvestigators may frequently be changed throughout the mission lifetime.

(3) Percent readiness is a composite, estimated from flight hardware elements started early in the program, and integration and test elements which occur later in development.

(4) Projected launch dates are planning dates used to develop OSSA budget estimates.

(5) Average fiscal year 1987 cost per month incurred while the programs are delayed.

(6) Astronomy payload [Astro-1]. This mission was ready for launch March 6, 1986. Hardware currently in storage awaiting reactivation approximately 18 months prior to flight.

(7) Astro-2, 3 are reflights of Astro-1 hardware. No significant delay costs occur until after flight of previous mission in the series. Scientific guest investigators are planned but not yet included.

(8) Shuttle High Energy Lab-1 [Sheal-1] was planned for an early shuttle flight. Instrumentation was also included on Sheal-2.

(9) Sheal-3 science payload contained all new science instrumentation, not yet in the hardware development stage. Instrument definition may be continued.

(10) Wide angle Michelson doppler imaging instrument [WAMDII]. Instrument provided by Canada for joint program with NASA.

(11) Sunlab-1 was planned as reflight of solar instrumentation from Spacelab-2 with some upgrades and a guest investigator program.

(12) Darksky was planned as reflight of high energy astronomy investigations from Spacelab-2 mission.

(13) Space Plasma Lab-1 [SPL-1]. This program has completed the definition phase.

(14) SPL-2 was a reflight of SPL-1 with augmented scientific instrumentation capability planned. No development cost anticipated until later in SPL-1 Program.

(15) Atmospheric laboratory for applications and science [Atlas-1], formerly Earth observation missions [EOM-1, 2, 3]. Reconfigured from Spacelab module reflight mission to a pallet-only series of missions.

(16) Atlas-2 and following missions were reduced versions of Atlas-1, planned at yearly intervals for atmospheric studies and as calibration underflights for UARS.

(17) Shuttle radar lab [SRL-1]. Shuttle imaging radar-C [SIR-C] now replaces previously reflight of SIR-B experiment from OSTA-3 mission. Reflight missions are anticipated.

(18) Space life sciences-1 [SLS-1]. Hardware essentially complete at development centers, awaiting shipment to KSC 12 to 18 months prior to next scheduled flight.

(19) SLS-2. Complimentary mission to SLS-1 with hardware well advanced.

(20) Spacelab-J. Joint Japanese-NASA mission with NASA experiments in life sciences and materials sciences. Only U.S. investigator and integration costs included.

(21) International microgravity laboratory-1 [IML-1]. Extensive complement of foreign investigators and guest investigators for investigations in life sciences and materials sciences.

(22) Material sciences lab-3 [MSL-3]. Experiment hardware is undergoing further work awaiting firm launch date. MSL followon flights are planned at 5 flights in the period 1988-93, down from the previously planned 16 flights in the same period.

Mr. NELSON. OK, we will resume in this room, at 10 o'clock in the morning, receiving the report, first time to the Congress, of the National Commission on Space, Doctor Tom Payne will be here to present.

We will look forward to resuming our hearing in the morning.

Thank you all for your participation; I appreciate it. The meeting is adjourned.

[Whereupon, at 4:40 p.m., the hearing adjourned.]

PAYLOAD PRIORITIES

FRIDAY, JULY 25, 1986

House of Representatives,
Committee on Science and Technology,
Subcommittee on Space Science and Applications,
Washington, DC.

The subcommittee met, pursuant to call, at 10:10 a.m., in room 2325, Rayburn House Office Building, Hon. Bill Nelson (chairman of the subcommittee) presiding.

Mr. **Nelson**. Good morning.

We continue today our subcommittee's hearings on payload priorities. The emphasis today is commercial, and we welcome this distinguished panel of witnesses which represent the commercial user community.

Our objective in these hearings is to get an understanding of how this Government should manage its launch resources and how it goes about balancing the needs of commercial, science, national security, and other space interests, so that we can have the assured access to space that is absolutely essential for this Nation.

Now, the commercial users are in a very delicate situation, almost a precarious limbo, because of the uncertainty, some of the mixed signals that have come out of the U.S. Government, and whether or not commercial payloads are going to be flying on the shuttle, and what kind of ELV's are going to arise, and whether or not there is a viable ELV industry, and how can it compete with foreign launchers—you know all of the scenario. That is what this committee is trying to pull together, so that we understand what ought to be the policy for the United States, and then we're going to go out and try to implement that policy through persuasion, through legislative vehicles, and any other means at our disposal.

Now, needless to say, we are frustrated just like everybody else is, including NASA, and that we had hoped that last week NASA could present, in these continued hearings on assured access to space, a manifest of which then you all could respond to. But that launch manifest is not ready. So we want to receive your testimony as to the ongoing process, including bringing in the facts about foreign launchers, including the fact of the Palapa decision by the administration, the fact of three orbiters instead of four, and the fact of how you, as commercial users, can have the access to space. We want to dig into every aspect of it.

Now, this committee requested and gratefully received the vigorous participation of AIAA in a workshop that was convened about 2 weeks ago on the U.S. expendable launch vehicle capability. And so, in large part, you all participated in that conclave, somewhere around Warrenton, VA. I have the reports. Even though I could not be there, all of our staff was there and they said it was a terrific hearing, a terrific meeting, good exchange of ideas. And so, for the record today, we want to have some of that same exchange.

In later hearings on this subject of assured access to space, we are going to be further exploring the ideas of the development of an ELV industry and examining the current policy and the current impediments toward that end. So we welcome you here today to help elucidate this important subject of assured access to space.

We will just proceed in the order of your name being printed on the witness list. So, Mr. Alper, we'll start with you, sir.

STATEMENTS OF JOEL R. ALPER, PRESIDENT, SPACE COMMUNICATIONS DIVISION, COMMUNICATIONS SATELLITE CORP.; KARL R. SAVATIEL, DIRECTOR, SATELLITE COMMUNICATIONS, AT&T; F. WILLIAM ZIEGLER, EXECUTIVE CONSULTANT, STRATEGIC SATELLITE PLANNING, THE WESTERN UNION TELEGRAPH CO.; T. STEPHEN CHESTON, VICE PRESIDENT FOR GOVERNMENTAL AFFAIRS, GEOSTAR CORP.; CHARLES D. WALKER, SPECIAL ASSISTANT TO THE PRESIDENT, McDONNELL DOUGLAS ASTRONAUTICS CO., FOR THE SPACE STATION PROGRAM; MICHAEL T. LYONS, VICE PRESIDENT, SPACE RESOURCES DIVISION, MCI TELECOMMUNICATIONS CORP.; AND JOHN M. LOGSDON, DIRECTOR, GRADUATE PROGRAM IN SCIENCE, TECHNOLOGY AND PUBLIC SAFETY, GEORGE WASHINGTON UNIVERSITY, APPEARING AS VICE-CHAIRMAN, PUBLIC POLICY COMMITTEE, AMERICAN INSTITUTE OF AERONATUICS AND ASTRONAUTICS; ACCOMPANIED BY JOHN CLARK, VICE PRESIDENT FOR PUBLIC POLICY, AIAA

Mr. **Alper**. Thank you, Mr. Chairman.

I would like to thank you first for the invitation to testify today before your subcommittee. We have submitted a written statement and what I would simply like to do is briefly summarize that statement and, according to the program that you have planned for the day, respond to any questions that you might have.

First I would like to speak briefly about the bona fides of Comsat Corp. in this arena. This is a panel talking about the commercial use of space. Comsat pioneered the commercial use of space for communications. We are a communications company, and if you take a look at the company in terms of the services and equipment that it provides, you could almost conclude that we were a space communications company. So the future success of the space business is critical to Comsat.

The first commercial communications satellite was launched in 1965. That was the Early Bird. We launched it. And since then, about 109 other commercial satellites have been launched for communications in the free world, and Comsat participated in some 60-odd of those launches.

We are also the largest, single private sector buyer of launch services in the world, not only for our own uses but through our role as signatory to Intelsat and Inmarsat, for those uses as well. So, obviously, our interest is very keen in this issue.

I would like to summarize five specific points for consideration as we look at the evolution of the Nation's launch policy. The first point is that we believe that the shuttle needs to continue to be available for commercial as well as Government launches in a transition period. There are commitments that are outstanding that need to be honored; there is going to be, and there is developing an enormous backlog that's going to have to be worked down.

We believe, as a second point, that expendable launch vehicles should become the primary launch vehicle for commercial purposes with the shuttle being available as a backup. In that backup mode, it should be priced at a level which would be at or above the expendable launch vehicle price so as not to compete with the primary mission of expendables. Now, saying that, we recognize that there are going to be unique requirements that can only be met by the use of the shuttle, and those need to be taken into account.

Looking to a longer term, we believe that action needs to be taken to assure that in the future the United States has at its disposal a cost-effective, efficient, new technology capability in launch vehicles. And we believe that this needs to be done through a research and development program which should be undertaken as a partnership between Government and industry.

The fourth point concerns launch insurance that's critical to the commercial space industry; we believe that this is a problem that was addressed. At the conference held—I think it was at Airlie House. There were proposals put forward of a partnership between the Government and the private sector, perhaps the establishment of some sort of an insurance company, with the initial pool of funds either provided by the Government or provided by industry and reinsured by the Government, and then the pool being maintained through contributions by industry. We think this is an issue which needs to be addressed.

My last point concerns the need for a fourth orbiter. There appears to be a requirement for a fourth orbiter, but we believe that if the funding for that orbiter were to be looked for within the NASA budget, the result would be to cripple NASA's ability to maintain its leadership and its scientific mission. We're concerned about that. We believe that the time may be right for the Government to look to the private sector for some or all of the funding for a fourth orbiter.

Mr. Chairman, this is a summary of my comments. I would be glad to take any questions.

[The prepared statement of Joel R. Alper follows:]

Testimony

of

JOEL R. ALPER

President, Space Communication Division

COMMUNICATIONS SATELLITE CORPORATION

Before

Subcommittee on Space, Science and Applications

Committee on Science and Technology

U.S. House of Representatives

July 25, 1986

Mr. Chairman, thank you for inviting me to testify before the subcommittee today. I also would like to thank you for the strong role you have taken in trying to clarify the nation's space policy and getting our space program back on track as safely and swiftly as possible.

COMSAT is in a unique position to guage the pressures coming to bear on the commercial launch industry, the problems facing commercial satellite providers because of lost launch capacity, and the competition that might result from the future development of additional launch capability by the U.S. and other nations. As the U.S. signatory to INTELSAT, the 110 member nation consortium that is the world's largest commercial procurer of satellite launch services, and as the signatory to INMARSAT, we have been here since the beginning and have seen every major change in the commercial launch business. We were NASA's first and most frequent commercial customer, and we used only NASA's launch services for many years. Yet, as an international organization, INTELSAT was encouraged to contract occasional launches with Arianespace, which is primarily owned by other INTELSAT member nations, after it offered very competitive launch prices. So we are already veterans of international satellite launch competition.

Now, because of the tragic destruction of the space shuttle Challenger, and the subsequent explosions of three separate expendable launch vehicles, the launch business has ground to a halt. As serious as this problem is, however, it does offer us an opportunity to examine the underlying problems carefully and develop proper solutions that will work for us in the years ahead and not inadvertently compound our problems.

The troubling reality is that the West--with all of its technological might--currently has no means for lifting satellites into orbit. When a European launch team was forced to push a button and blow up its wayward Ariane rocket seconds after liftoff on May 30, Western nations temporarily lost their only alternative for launching satellites. The Challenger tragedy had already brought the U.S. shuttle program to a standstill. The Ariane explosion merely capped an incredibly unlucky string of mishaps that also put expendable launch vehicles (ELVs) off-limits for the time being. In light of these failures, satellite insurance is now virtually unobtainable.

BACKGROUND

When the Nixon administration proposed the development and operation of a Space Transportation System over a decade ago, a key rationale was its improved efficiency over such expendable launch vehicles (ELV's) as the Atlas/Centaur or the Delta. The STS, later known as the Shuttle, would be re-usable and six of them would be launched and re-launched 36 times per year, thereby reducing the cost of low earth orbital launches from the 1970 standard of about $1,500 per kilogram to the 1970 NASA Shuttle price estimate of $135 per kilogram.

Based on these quite optimistic expectations, it soon became NASA policy that there would be no room for expensive ELV launches in an era of very cheap Shuttle launches. Consequently, as early as 1969, NASA began to plan for a phase out of the U.S. ELV capability.

By 1974, however, the design and cost of the Shuttle were better understood and NASA's public estimate of the cost of low earth orbital launches had risen to $339 per kilogram, still a fraction of the ELV average of over $1,000. Between 1974 and 1981, when the first Shuttle flew, NASA's reckoning of per kilogram low earth orbital launch costs gradually crept up past $1,000 to its present-day $3,500 level. During the same period, the cost per kilogram of comparable ELV launches rose to around $2,000.

Naturally, accounting for such statistics is both complex and controversial. The Shuttle and every available ELV have been developed by governments primarily for governmental use. Estimating the per kilogram cost of a low earth orbital launch requires assumptions and judgements on what should or should not be included.

As the technical complexity of the Shuttle system grew through the 1970's, so too did its cost even as the number of planned flights per year fell from 36 to 24 and eventually to 16. And as its cost grew, the Shuttle's economic advantage over the ELV's shrank and then disappeared. This caused a shift in NASA/Nixon-Ford-Carter Administration policies. ELV's, by 1977, were to be phased out not so much because they couldn't withstand the economic competition from the Shuttle, but rather because they could. In 1979, over the objections of the military, the ELV manufacturers and the satellite user industry, ELV's were being phased out (i.e., NASA stopped ordering Atlas and Delta rockets) to ensure wider near-term usage of the Shuttle.

Non-Shuttle Services

Throughout the early 1970's, several multilateral western European consortia had been developing rockets for experimental purposes. In 1975, these organizations coalesced into the European Space Agency (ESA) which established the development of an independant European satellite launch capability as its top priority. The first European rocket, the French-designed Ariane 1, flew in 1979. By that time, the Europeans had shifted their strategy from an experimentally oriented space program to a commercially oriented one.

In 1980, Arianespace, a corporation, was formed to market the ESA's Ariane launch services to governmental and commercial satellite users. That same year, Arianespace unsuccessfully tried to launch a communications satellite on an Ariane 1. In 1983, INTELSAT became Arianespace's first genuine, successful, commercial customer, followed by GTE in 1984. Since its founding, Arianespace -- which is one-third owned by the French Government, one-quarter owned by French investors and one-fifth owned by German investors -- has pursued a policy of under-pricing NASA's Shuttle in order to gain market share. By 1986, the firm had 14 successful launches and had succeeded in booking over a dozen commercial launches through the end of the decade on terms generally substantially less than the shuttle.

Soviet commercial launch services were generally thought to be inconceivable until quite recently. In 1983, however, the Soviet Union publicly proposed that INMARSAT launch its forthcoming satellites on a Proton rocket from the Tyuratam launch site, for about two-thirds the price of an Arianespace launch. While the Soviet bid was not accepted, it did illustrate the potential for a third source of launch services, although U.S. export controls would have almost certainly prevented any American satellite from being turned over to Soviet launch authorities.

Similarly, the Chinese Long March launch system was recently presented to Western satellite users as a commercial service at prices about half those of Arianespace, but with fairly limited capacity. Although export limits similar to those applied to the Soviets could also apply to the Chinese, at least one American satellite user has announced that it intends to use the Long March to launch domestic commercial satellites.

Japan, Brazil, and India each have developed experimental ELV capabilities which could have the potential for limited commercial services during the mid-1990's, although a Japanese ELV service is thought to be a possibility by 1992. In the same category of "next decade" possible launch services would also fall Space Services, Inc. and Starstruck in the United States, OTRAG in Germany and Bristol Aerospace of Canada, all small start up organizations that propose to develop new, economic launch services for small payloads.

Finally, three existing U.S. ELV's have the potential for future commercial use, although is are under contract to do so at present. The Titan, until now used only by the Air Force, has been used for launches since 1956. Built originally as an ICBM by Martin Marietta, it has gone through many modifications during its 30-year history, the most recent of which is under way now. The new Titan CELV (Complementary Expendable Launch Vehicle) is being built for the Air Force for delivery in 1988 or 1989. Martin has indicated that the Titan CELV could be commercially available by the early 1990's, except that they could not price its use at rates competitive with either the Shuttle or with Ariane.

The Atlas-Centaur, built by General Dynamics as an ICBM for the Air Force in 1958, has been used by NASA for civilian launches since 1966 and for commercial launches since 1982. 15 Atlas or Atlas-Centaur rockets are in varying stages of production, 14 of which are dedicated to either the Air Force or the Navy. General Dynamics indicates that additional Atlas-Centaurs could be available for commercial launches about 2 1/2 years after an order for them has been placed. Like Martin, General Dynamics believes that it can not profitably price Atlas-Centaur launches competitively with either the Shuttle or the Ariane.

The Delta, originally called the Thor by its manufacturer McDonnell Douglas, had been the mainstay of NASA-provided commercial launch services. As with the Atlas Centaur, NASA terminated its use of the Delta in 1979. Today, three rockets remain and all are committed for NASA or Air Force launches. McDonnell Douglas believes that commercial Delta launch services could be available with about two years' notice, but that it cannot price the Delta competitively with Ariane or the Shuttle. At the same time, Transpace Carriers, Inc., has proposed to commercially operate an improved Delta rocket launch service during the 1990's.

Current Launch System Issues

Between late January and early June of this year, nearly every major commercially available launch system failed, all in spectacular and costly explosions: The Shuttle Challenger, a Titan 34-D, a Delta, and an Ariane 2. As a result, none of these systems is currently available, although the Titan, the Delta's and the Atlas would not have been anyway. Moreover, although Shuttle launches may resume in mid-1987 and Ariane launches in late 1986, it appears that no launch insurance is likely to be available for existing services on economically acceptable terms for some time to come. Finally, a White House Senior Interagency Group on U.S. Space Policy has recently proposed that future Shuttle launches be dedicated exclusively to government payloads.

Under these circumstances, no U.S. commercial launch capability would be available until 1988, if then. Beyond 1988, the U.S. rocket manufacturers maintain that they could not compete with Ariane prices, and if Arianespace insures its own launches -- as it has indicated it could -- then even the availability of the Shuttle for commercial launches might be moot since uninsured commercial launch capacity would probably be uneconomic, given the very high cost of satellite users' self-insurance.

Four issues emerge for U.S. policy:

(1) Should the Shuttle be dedicated wholly to government payloads (and if it is, what about satellite owners who have already booked Shuttle space?)

(2) Should the federal government encourage and subsidize the development of commercially available ELV's?

(3) Should the Government encourage and subsidize the availability of commercial satellite launch insurance?

(4) What role should the government play in launching commercial satellites?

Government Role

In other nations, launch services are government owned and/or subsidized. Moreover, U.S. policies have discouraged the development of commercial launch capacity. Consequently, there is none. Clearly, there needs to be launch vehicles available for commercial satellites besides the Shuttle. Given the advantage foreign government owned/subsidized have, the U.S. Government should take the lead in developing U.S. non-government launch capacity by providing financial and other inducements for the production of expendable launch vehicles.

Insurance Policy

Ford Aerospace has recently proposed the creation of a government-backed, commercial satellite insurance program. The program would insure U.S. launches only (competing directly with an Arianespace insurance program) and would offer satellite insurance at rates of about 20%, by using 25-year actuarial experience.

The initial capitalization of the Ford-proposed federal insurance company would probably be about $300 million and that amount would come from federal appropriations. Futher capitalization would come through the privatization of the venture (i.e., turning it into a shareholder-owned corporation) and through premiums.

This proposal reflects one of three main approaches that seem to be emerging to deal with the launch insurance problem. The second is a satellite industry-financed insurance pool through which a cross section of satellite manufacturers, operators and users would be permitted to pool resources into some type of insurance fund. The third is a practice of launch-by-launch self insurance or insurance by the manufacturer.

SUMMARY

The present hiatus in the shuttle and ELV launch programs has grounded American commercial space interest and forced an overdue reassessment of U.S. space policies. We are now rethinking all of our long-held assumptiions and redefining our long-range goals and objectives. We must make the most of this opportunity and find a way to reassert U.S. pre-eminence in space, which is one of our most precious national assets. Otherwise, we most certainly will lose out to government-subsidized foreign competitors who are poised to step in and fill those needs we are unwilling to satisfy.

A major objective, endorsed by the President's Commission that investigated the cause of the Challenger catastrophe, is to develop a versatile mixed fleet of satellite launchers--composed of shuttle orbiters and various types of ELVs--that will provide reliable access to space at costs that are competitive with launch services offered by other countries. The present policy questions center on how best to arrive at this goal.

I am convinced that the government must play an active role in revitalizing this nation's launch vehicle industry. At least for the near-term, cooperation between government and industry is necesssary, in the form of joint ventures, partnerships, subsidies or other incentive programs. Private-sector initiatives alone will not deliver us from the present crises and, in fact, could place us in further jeopardy. The risks are too great to be borne solely by industry.

New government policy is needed to ensure that customers of launch services have the widest possible options open to them. To maximize choice and foster a strong competitive U.S. industry, we believe any new launch policy should provide for the following:

RECOMENDATIONS

First, the Shuttle must continue to serve both government and commercial customers through a transitional period. Certainly, the nation's defense needs will take priority once the Shuttle resumes flying, but commercial payloads should not be excluded from the Shuttle. Moreover, NASA must honor its commitments to foreign and commercial users for Shuttle launches that were made prior to the Challenger accident.

There are those who hold that the ELV market will be served best if it is not required to compete for commercial business with the Shuttle. However, merely removing commercial payloads from the Shuttle will not in itself spark significant ELV development activity. The launch vehicle market is highly specialized and will remain so no matter what type of cargo is deemed appropriate for the Shuttle. An individual manufacturer has no reason to produce more than one type of core launcher. The market is simply not big enough. Demand is not strong enough.

Second, the government should ensure the future availability of cost-efficient expendable launch vehicles for commercial satellite launches. Doing so will benefit both government and commercial satellite operators, ensure launch alternatives to the Shuttle, reduce costs to users and keep America competitive with foreign expendable launchers.

In implementing such a policy, the President should encourage a joint government and industry effort to develop a new generation of reliable and less expensive rockets for commercial satellite launches. The effort to develop these new rockets should be financed by both industry and government as a counter balance to foreign government subsidy of some foreign launchers. Such a new generation of ELVs will ensure America's competitiveness in commercial space for the decades to come and take the government out of a position of competing with industry.

Third, in order to develop a viable commercial ELV industry in the United States, National Policy should state that U.S. ELVs will be the primary launch system for commercial and foreign users unless the unique capabilities of the Shuttle are requred. The Shuttle should be considered a backup to ELVs and Shuttle launch prices should not be less than those offered by ELV manufacturers.

Fourth, the problem of launch insurance is one shared by the public and the commercial space industry, and the federal partnership with the private sector will be necessary to solve it.

Through the appropriate federal agency, the government should provide the initial capitalization for a pool of funds that would re-kindle American satellite launch insurance. The size of the pool would be maintained by actuarially based premiums paid by industry. The pool could be administered by a trade group, a consortium of insurance companies or the government. With such a one-time federal infusion, the private sector will once again take over the critically important task of insurance.

Finally, for the suggested policy to work and for the government to have sufficient capacity to satisfy its own launch needs, a fourth orbiter. If, however, funding for an orbiter comes from the NASA budget at the expense of other high priority items, it will cripple NASA's ability to maintain the United States' leadership in many scientific endeavors. It will exacerbate the problem of putting the United States behind other nations in space and other technologies. There needs to be some middle ground between crippling the existing budget and finding new funding. Perhaps it is possible to introduce some level of private sector financing to fund some part or all of an additional orbiter.

CONCLUSION

The U.S. has reached a critical juncture in its efforts to move ahead with the commercialization of space. At stake is nothing less than the continued competitiveness of the U.S. space industry. We are in desperate need of a sound commercial launch vehicle program. American prestige is on the line, and the policies we adopt in the next several months will determine whether the U.S. will be able to maintain its leadership in advancing the commercial uses of space.

(0133G)
7/25/86

Mr. NELSON. Thank you, Mr. Alper.

Mr. Savatiel.

Mr. SAVATIEL. Thank you, Mr. Chairman, and good morning.

I am the director of Satellite Communications for American Telephone & Telegraph, and I have a brief statement prepared which I would like to summarize the first few paragraphs and then read from the statement.

I think we are aware that AT&T is also a very large user and operator of satellite services. We operate three satellites in our TELSTAR system today. We also have a large number of clients who use our satellite services. It is from this perspective that I would like to address the committee today, not from a scientific one, but from the user perspective.

The applications that we provide over our satellite are many—major broadcast networks, digital services, specialized networks for various business clients and, of course, message telephone service for the general public. The users of our service are concerned about the long-term viability of satellite technology as the appropriate delivery vehicle for their information needs. They and we have made extensive investments in Earth station networks to take advantage of the unique capabilities of satellites, that is, the broadcast capability. In addition, there are data applications used by businesses with multiple locations which require significant Earth station investment to enable the clients to realize the advantage of the satellite technology.

The existing networks and emerging applications are in jeopardy if we, as service providers, cannot guarantee the availability of satellite capacity beyond our existing operating systems. The long leadtimes of 3 to 4 years involved in constructing and launching satellites, coupled with the substantial up-front capital investments for satellite services, makes this business risky.

Our current situation of not being able to accurately forecast the dollar requirements for launch capability and/or, as Mr. Alper said, launch insurance, makes the business risk abnormally high and we feel it will impact the availability of follow-on systems to those available in the sky today. Therefore, AT&T supports the immediate need for developing an ELV capability here in the United States. The establishment of such capability will ensure that the competitive advantages of different systems will be available to various satellite manufacturers and users.

We believe the competition currently available from Arianespace and others is welcomed in the marketplace. Our concern is, without the immediate establishment of an American ELV capability, current plans to replace existing systems are in serious jeopardy.

The shuttle is a natural resource to the United States and should be used as such. STS applications should initially be concerned with scientific and Government uses or those requiring manned spacecraft. The Shuttle Program has significant time pressures to once again become the leading technology in the world, and commercial applications should not hinder this effort, although, if appropriate it should be made available as an alternate launch source.

The next paragraph of my prepared statement basically says that we offer a wide range of services to customers which are based upon the appropriate technology, not necessarily being satellite. But we feel there are some unique services that the satellite addresses itself to. We feel it plays a strategic role in the development of full service capabilities—the satellite, that is—providing the American marketplace with state-of-the-art information gathering and dissemination capabilities. Increased access and connectivity to information will help maintain our competitive edge in research and business.

The linchpin in being able to provide these services is to have an existing competitive ELV capability and some chartered reasonable insurance capability. If these options do not exist, communications providers like ourselves will use other technology alternatives which perhaps are not best suited for the applications but are commercially available and financially attractive.

Thank you. I will be available to answer questions.

Mr. **Nelson**. Thank you.

Mr. Ziegler.

Mr. **Ziegler**. Thank you, Mr. Chairman.

Western Union has operated up to five satellites in orbit. Currently we are operating only three because our first two have been retired. As you know, we lost Westar VI in early 1984 due to an upper stage failure, and we are now waiting for a launch for its successor, Westar VI–S. Because of this, we now have inadequate capacity in orbit and a fairly expensive satellite in upper stage on the ground and no way to get it launched.

NASA has recently advised us that under their schedule that Westar VI–S launch comes out in December 1989. That's probably going to slip further. Obviously, we're looking elsewhere for a near-term launch, and we are doing that. We do have FCC authorization to fill six orbital slots, four C-band and two Ku-band. That's our current situation.

In our reports on policymaking for the Nation is that, first, there should be a mixed fleet that is alternative launch capabilities for all classes of users. We think this is true for the Department of Defense, for foreign users, for commercial users, and perhaps there are some scientific users that could afford to wait for an alternative source.

We think this is a very important part of getting a date certain for a launch, which is important to commercial users because they have a big investment in satellites and upper stages and they can't afford to have that sitting idle on the ground.

In August—and the second point of this has to do with reliability. In August 1984, I made a recommendation to this subcommittee that an independent review function be established to continuously review the design, manufacture, qualification, and test of all propulsion systems designed and manufactured within the United States. At that time we pointed to a recent experience of propulsion system failures, and at that time we could see an Ariane third stage, an IUS upper stage, two PAM–D's, a Centaur, and a shuttle main engine. Now, again we are looking at a rash of recent failures, including two Titans, a Delta, two more Ariane third stages, and a shuttle booster rocket. The question is, how many times do we have to experience such losses before we learn that something must be done about it?

We have already seen insurance coverage severely reduced and the premiums skyrocket—the premium rates skyrocket.

I repeat the recommendation of August 1984. A national independent review function must be established to continuously review the design, manufacture, qualification and test of all propulsion systems designed and manufactured within the United States.

I might comment here that manufacturers of propulsion systems squirm at this. They claim they've been reviewed to death. Obviously, it hasn't been effective and we need to bring our talents, and ingenuity, and so forth to finding higher reliability.

I believe this review function should provide their results to the launch agencies as well as their customers. In particular, they should participate in all launch-readiness reviews and provide a go-no-go recommendation. The question of U.S. Government liability in doing this should not arise because all launch contracts now have—contain a cross-waiver of liability provisions, and it is presumed this would continue. In addition, the review function is advisory, not compelling.

Regarding commercialization of ELV's, commercial users really don't care whether it's a Government-sponsored launch or a viable commercial sponsorship. We're interested in low cost, and a date certain, and things of that nature, but who the entity is that performs the launch is academic to us.

It also seems to us that a commercial ELV enterprise is not going to be viable unless it has Government help. I have suggested a few items that could be done in order to help them.

At least one launch agency, Martin, has stated that all they need is to not have the U.S. Government compete. However, I think there are other Governments that will compete, and the number of other Governments is increasing. In any case, the possibilities for help for launch agencies include NASA or DOD purchase of ELV's for launching payloads in the growing backlog of the STS. Not only would this help to relieve the backlog but would relieve the commercial entities of costs of restarting the production lines.

Establishment of a national, independent review function for U.S. propulsion systems would not only provide the Government added assurance of higher reliability, but would do the same for commercial ELV entities.

Use of Government facilities, such as ranges, launch pads, et cetera, at little or no cost.

Permission for NASA, DOD, and other Government agencies to use commercial ELV's if technically appropriate. This would encourage commercial entities as well as spread the Government's risk.

Provision of excess liability coverages for the launch agencies. This commercial user can buy liability coverage up to a certain amount, but the excess over that needs to be covered by the Government, as it is now in the NASA launch service contracts.

I have indicated in my formal statement some other policymaking considerations, and I will just outline them quickly.

Commercial entities, such as Western Union, need a launch date which is reasonably certain; the launch itself must be insurable at reasonable rates, not only covering the launch vehicle but covering the total loss that might be incurred; contracts must be available on a fixed-price basis; priority and scheduling conflicts should be—excuse me—priority and scheduling policies should be consistent; and NASA should honor contracts executed prior to the shuttle tragedy; adequate failure review should be assured by the Government.

Thank you, Mr. Chairman.

[The prepared statement of F. William Ziegler follows:]

TESTIMONY OF F. WILLIAM ZIEGLER BEFORE THE SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS OF THE COMMITTEE ON SCIENCE AND TECHNOLOGY OF THE U.S. HOUSE OF REPRESENTATIVES, JULY 25, 1986

My name is F. William Ziegler. I am a graduate engineer with approximately 45 years experience. I have been employed by The Western Union Telegraph Co. for the last sixteen years in various positions related to communication satellites. My current title is Executive Consultant, Strategic Satellite Planning. In general, my responsibilities have been those of a Program Manager for the planning, procurement, launch and initial operations of communications satellites.

WESTERN UNION's BACKGROUND

Western Union's Westar system began operations in 1974 with the launches of Westars I and II by NASA on Delta 2914 vehicles. Westar III was launched in 1979, also by the Delta 2914. Westars IV and V, twice the size and capacity of the prior Westars, were launched in 1982 by the Delta 3910 plus PAM upper stages. Western Union did operate all five of these satellites (two of them were at one orbital location) at one time but are now operating only three (Westars I and II have been retired). Westar VI was successfully deployed by the Shuttle in early 1984 but suffered an upper stage failure which left it in low orbit. This satellite, along with Palapa B-2, was retrieved by NASA for some of the underwriters who insured the launch. Westar VI-S, it's successor, would have been launched last month but for the Challenger tragedy.

We now have inadequate capacity in orbit, a fairly expensive satellite and upper stage on the ground, and no way to get it launched.

NASA has most recently advised us that WESTAR VI-S is now scheduled on the Shuttle in December, 1989 and this schedule is slipping. Obviously we must look elsewhere for a near term launch and we are doing that. We do have FCC authorization to fill six (6) orbital slots (4 C-band and 2 Ku-band).

CONSIDERATIONS FOR LAUNCH VEHICLE POLICY MAKING

In the wake of the Challenger tragedy of January 1986, it is believed that it is well recognized that the United States must have alternative launch capabilities. This is necessary to provide for national security, to assure the scientific objectives of the nation, to meet the needs of our foreign friends and allies, and to protect the business interests of our commercial entities. All classes of satellites should have unrestricted access to all launch vehicles subject only to the usual priority provided for national security missions and to scientific payloads which have narrow launch windows.

In August 1984, I made a recommendation to this Subcommittee* that an independent review function be established to continuously review the design, manufacture, qualification and test of all propulsion systems designed and manufactured within the United States. At that time we had experienced recent propulsion system failures of (i) an Ariane third stage (ii) an IUS upper stage, (iii) two PAM-D's (iv) a Centaur, and (v) a shuttle main engine. Now, again we are looking at a rash of recent failures including (a) two Titans, (b) a Delta, (c) two more Ariane third stages, and (d) a shuttle booster rocket. How many times do we have to experience such losses before we learn that something must be done about it?

We have already seen insurance coverage severely reduced, and the premium rates skyrocket.

I repeat the recommendation of August 1984. A NATIONAL, INDEPENDENT REVIEW FUNCTION MUST BE ESTABLISHED TO CONTINUOUSLY REVIEW THE DESIGN, MANUFACTURE, QUALIFICATION AND TEST OF ALL PROPULSION SYSTEMS DESIGNED AND MANUFACTURED WITHIN THE UNITED STATES. This review function should provide their results to the launch agencies as well as their customers. In particular, they should participate in all launch readiness reviews and provide a "Go" or "No Go" recommendation. The question of U.S. Government liability should not arise because all launch contracts now contain cross-waiver of liability provisions and it is presumed this would continue. In addition, the review function is advisory not compelling.

COMMERCIALIZATION OF ELV's

The needs for alternative launch sources (others have called this "a mixed fleet concept") and for a national independent review function exist regardless of any decisions which are reached about commercialization of ELV's. Generally commercial and foreign users wouldn't care whether it had a launch provided by the U.S. government or by a viable commercial entity with a demonstrated track record as long as other terms and conditions were equivalent. Most commercial users now have their satellites designed for multiple launch vehicle compatibility.

The problems arise in establishing viable commercial entities in the launch business. One or two entities seem to say that all they need is a U.S. Government commitment that it won't compete. However, other governments will compete and seem willing to subsidize their service to get the business. And the number of "other" governments are increasing!

It seems to us that some form of U.S. Government assistance is required if viable commercial ELV's are to become a reality.

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* This sub-committee passed on the essence of this recommendation to the Committee on Science and Technology in October 1984.

Possibilities include:

1. NASA or DOD purchase of ELV's for launching payloads in the growing STS backlog. Not only would this help to relieve the STS backlog but would relieve the commercial entities of the costs of restarting the production lines.
2. Establishment of a national independent review function for U.S. propulsion systems would not only provide the government added assurance of higher reliability, but would do the same for commercial ELV entities. Users would be encouraged thereby to use commercially supplied ELV's.
3. Use of the government facilities such as ranges, launch pads, explosive safe facilities, etc., at little or no cost.
4. Permission for NASA, DOD or any other government agency to use commercial ELV's if technically appropriate. This would encourage commercial entities as well as spread the government's risks.
5. Provision of excess liability coverage for launch agencies and their customers.

OTHER POLICY MAKING CONSIDERATIONS

Commercial entities such as Western Union require:

1. A launch date which is reasonably certain.
2. The launch itself must be insurable at reasonable rates, not only covering the launch vehicle, but covering the total loss that might be incurred.
3. Contracts must be available on a fixed price basis.
4. Priority and scheduling policies should be consistent.
5. NASA should honor contracts executed prior to the shuttle tragedy.
6. Adequate failure review should be assured by the government.

I would like to thank this subcommittee for this opportunity to express our views regarding the nation's launch policy.

DATED: July 24, 1986

F W Ziegler

F. W. Ziegler

Mr. **Nelson**. Thank you, Mr. Ziegler. You, indeed, did make that recommendation to us, and indeed, that recommendation was part of the report of this subcommittee, printed in October 1984—

Mr. **Ziegler**. That's correct.

Mr. **Nelson** [continuing]. In which it said NASA, in cooperation with other appropriate agencies, is requested to provide a report to the subcommittee by April 15, 1985, regarding if, when, and to what extent this proposal would be adopted. And this was the proposal of instituting an independent and continuous review of the design, manufacture, qualification, and test of all propulsion systems produced within the United States.

Now, in essence, NASA responded and said that they did not want to be in the position of certifying these systems. Nevertheless, if they had followed through on that request by this subcommittee, perhaps things would be a little bit different today than they are.

Mr. **Ziegler**. That's correct. In my August 1984 testimony, I did recommend that that committee have a veto right on launches. I have since modified that to recommend that they have a recommendation responsibility.

Mr. **Nelson**. Thank you, Mr. Ziegler.

Dr. Cheston.

Dr. **Cheston**. Thank you, Mr. Chairman. I am vice president of Geostar Corp. for governmental affairs.

First, I would like to say that last September I had the pleasure of presenting to the committee a revolutionary new satellite application called radio determination satellite service. We reviewed the placing in the hands of ordinary citizens devices like this to allow them to interact directly through satellites with other people so equipped, no matter where they were at.

We launched our first relay, our radio determination satellite service, last March. We will be connected with four launches in the 1980's and expect to be connected with or making our own dedicated launches with 6 to 10 satellites in the 1990's. So we're going to be a fairly high volume operation.

Because of the numerous applications of this technology for governmental use, including the Drug Enforcement Agency, Customs, and so forth, we negotiated with NASA last November a Modified Launch Services Agreement which recognized our status as an entrepreneurial company. That means, in the absence of revenues, given the high expense, high risk of developing space technology, you had to invent techniques to reduce the risk because the normal financial community was not going to support it.

One of the things we did was to develop introductory new technology systems which operated with lower costs than normally dedicated satellites.

Second, we did negotiate this Modified Launch Services Agreement with NASA which allowed us to pay for the launch of our first three satellites after launch instead of before launch. In addition, though, to protect the public interest, NASA ensured that we paid interest on those deferred payments. So here NASA developed a very clever institutional instrument which on the one hand protected the public interest, that allowed space commercialization to go forward in a natural, dynamic process, and allowed it to compete internationally.

By the way, in regard to internationally, since our testimony last September we have been approached by numerous countries around the world for developing compatible systems with us, with U.S. participation, therefore enhancing U.S. exports.

Now, in the policy tumult that has followed the post-shuttle disaster, everything has gone up for rereview, including NASA's previous agreements. Now, the Modified Launch Services Agreements were awarded to only two organizations, both offering highly innovative technologies that would enhance U.S. positions, where small organizations needed these Modified Launch Services Agreements to allow their financing to go forward.

Now, all we ask in the final deliberations, the final decisions on the policy review, is that adherence to the initial agreements be maintained. We make no comment on future agreements. It's a very simple request, but one that will enhance us greatly. To be very frank, I have been brushing up on my French—I pulled out my first Chinese dictionary last week. We are having to reach into all options. We would really look forward to flying in the 1990's on the shuttle with our relays, because that would allow us to take the benefits of the Modified Launch Service Agreement and have the United States obtain the launch revenues.

Thank you.

[The prepared statement of T. Stephen Cheston follows:]

TESTIMONY OF T. STEPHEN CHESTON
VICE PRESIDENT FOR GOVERNMENTAL AFFAIRS
GEOSTAR CORPORATION, PRINCETON, NEW JERSEY
TO
SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
JULY 25, 1986

Chairman Nelson and Members of the Committee:

During hearings last September on entrepreneurial space enterprises and the federal procurement process, I had the pleasure of sharing with this Subcommittee the emerging success story of Geostar and its revolutionary new technology known as Radiodetermination Satellite Service (RDSS). Together we reviewed the lifesaving and economic efficency aspects of RDSS applications which will allow users to have reasonably priced, handheld devices for the transmission and receipt of locational and directional information and digital messages. The applications include coordinating emergency relief efforts to save human lives during disasters and improving the management of truck, railroad, and marine fleets through the new found ability of headquarters to immediately locate and communicate directly with each field unit on a national or international scale. Eventually, the technology is seen as allowing individuals to locate and communicate with family members and professional associates whether they are driving across the prairies of Nebraska or walking down the streets of Washington.

Given the versatility and flexibility of RDSS technology, various agencies of the federal government have approached

Geostar for test units to study the adaptation of RDSS to their specific needs. The interest of these federal agencies was a factor in encouraging the Federal Communications Commission to expedite allocation of the frequencies required for RDSS, which it did in July 1985, and reaffirmed in May 1986.

During the September hearings we also discussed the special economic circumstances that Geostar faced as a preoperational, entrepreneurial space technology company. Given the absence of revenues and the great expense and risk in developing space technology, Geostar could not rely totally on standard financing techniques. The financial community was not prepared to underwrite the enterprise unless up front costs were reduced by technological or other measures. Technologically, Geostar reduced costs by developing less capital intensive introductory systems, known as LINK ONE and PRIME .

Other cost reduction measures required innovative financial approaches. NASA recognized this, along with the fact that other federal agencies were interested in using RDSS technology. To advance the goals of U.S. space commercialization policy and to help make RDSS technology available for governmental and general public use, NASA provided Geostar with a Modified Launch Services Agreement (MLSA) last November. In it Geostar pays its launch costs for three satellites after launch from revenues. NASA will charge Geostar interest on the deferred payments to fully protect the public interest.

The MLSA has been of great value in financing the introduction of RDSS technology. It has substantially reduced the amount of investment needed before receipt of major revenues and therefore made RDSS much more attractive to the financial community. In fact, Geostar's representations about the MLSA to the financial community has influenced investors to place capital in RDSS technology.

The Geostar MLSA is a solid achievement of America's space commercialization effort. In effect, an agency of the federal government developed a financial instrument that on the one hand, fully protected the public interest and, on the other, enhanced the financial environment for an entrepreneurial space technology to be developed for domestic and international use. Parenthetically, in regard to the latter, RDSS has been receiving a warm reception from the global community. Numerous countries have approached Geostar concerning developing compatible systems with U.S. participation, which will enhance American exports.

The post-Challenger disaster policy tumult that has swept America's space effort has focussed to large degree on space commercialization. Many creative ideas have been put forth and broad consultation made with an apparent consensus that space commercialization should not only continue but, in fact, be given new impetus. The deliberations of the Economic Policy Council's Commercial Space Working Group has been of great value in re-

resolving policy problems. As a member of an entrepreneurial space organization, I am pleased to see that the policy review seems to be coming to a close in timely fashion and that firm direction will be provided to both the public and private space communities in the near future.

Frankly, there is one genuine concern, however, which should be noted by this Subcommittee, given its oversight and leadership roles in the development and implementation of space policy. The MLSA is a unique financial invention that to my knowledge has been provided to only two organizations; each ~~of~~ is ~~are~~ small, young, entrepreneurial, preoperational and offering highly advanced and valuable technologies. Those of us who have received MLSA's have been making steady and solid progress in entrepreneurial space commercialization. We now may find ourselves, inadvertently, to be the next innocent victims of the Challenger disaster.

Part of the post-Challenger policy review process has been to deliberate the disposition of NASA's obligations to launch commercial satellites and the agreements related to them. Whatever the outcome of these deliberations, the MLSA's that have been negotiated to date should be preserved. They are legal agreements that are highly creative in their approach to advancing U.S. space commercialization. The actual implementation of them will, of course, be determined by the launch schedule and payload priorities established by the policy review.

(5)

Whatever the case, by fully maintaining the MLSA's negotiated to date and keeping alive the opportunity to implement them, the U.S. Government will have lived up to its legal obligations and kept another arrow in its quiver for U.S. competition in the international environment of space commercialization.

Mr. NELSON. Thank you, Dr. Cheston.

Mr. Walker, it's a pleasure. I had the privilege of working and training with Charlie, and he is a valued colleague and friend. Welcome to the committee.

Mr. CHARLES WALKER. Thank you, Mr. Chairman, and Mr. Walker, good morning.

I have a prepared statement which I have submitted to the record. I would like to briefly, very briefly, read from that statement, and then read into the record the conclusions of the testimony.

I do appreciate this opportunity to address the impact of the loss of *Challenger* upon the commercial user community from our standpoint. I want to begin with, just very briefly, some background to put our assessment in perspective.

The McDonnell Douglas Corp. has been continuously involved in this country's space activities. We believe that with the space transportation system, came the promise and expectation of frequent and more economic access to space. McDonnell Douglas understood the potential rewards and the risks involved and manifested with the STS.

In 1976, our corporation supported studies of the potential uses of the STS for commercial materials processing. Highvalue, fluid processed pharmaceuticals was the most attractive such use. The result was company funding of the new business effort that became the electrophoresis operations in space project, that I'll term "EOS" from this point on.

Following considerable engineering effort, by 1979 the company was prepared to fund space-based hardware and process development with a few launches underwritten by NASA. In January 1980, NASA agreed to provide that flight support by signing the first Joint Endeavor Agreement based upon a policy to promote industrial commercialization.

We have flown on seven shuttle flights, developing the process and a product, erythropoietin, which I will call EPO from this point on. The hormone EPO is naturally produced in the kidneys and it stimulates red blood cell growth. In pure form, this hormone will be a breakthrough treatment for anemias, most immediately for dialysis patients.

Without the experience of these missions, we could not have confidently completed design of the larger production prototype system—that is, the orbiter cargo-bay payload that we have yet to fly—nor could we satisfactorily have judged the economics of space-based pharmaceutical processing.

The EOS project's objective in the establishment of a processing service for high-value organic materials is to provide those materials, initially pharmaceutical. It is the intent of McDonnell Douglas to produce, process and market materials with nonaerospace industry partners, partners who have the knowledge and working experience with selected products and their markets.

Well, having come as far as we have in this, what does the post-*Challenger* era mean to the EOS project? Certainly the reason why we're all here today is that we expect flight opportunities for commercial production and new product development will be more limited. However, with recent advances in genetic engineering, and our investment in biotechnology at McDonnell Douglas, the impact of this new reality is not life-threatening to the commercial effort's existence today. A year ago it would have been different. But now we are confident that the cost of producing and processing enough EPO to meet U.S. market demand annually is essentially the same, whether the electrophoresis purification process is performed on earth or in space.

Now, what I'm saying is that we don't have to rely solely upon space in the next few years for this one product, EPO. But our experience in space and on the ground with other pharmaceutical and medical products will, from our research experience, require degrees of processing or processing conditions. The commercial EOS effort has as a goal the technology and production capability to utilize space when economically appropriate. Some substances will most certainly require space for economical processing.

Our middeck continuous flow electrophoresis system verifies and refines process conditions for space production. The cargo-bay attached system will be the factory for large-scale product purification in space. And since the EOS cargo-based system has multiple electrophoresis chambers, it could be utilized to process more than one product simultaneously. This will effect both product economies and availability of product quite positively.

In conclusion, let me just say that McDonnell Douglas, as a commercial user of the STS, will continue to need the use of the space shuttle for,

Number one, flights of the EOS attached cargo-bay factory, and, in that case, two in-flight qualifications are scheduled. And then, for subsequent reimbursement flights for production of pharmaceuticals, and

Second, flights of the middeck system, including a payload specialist, when appropriate, for both NASA research and McDonnell Douglas new product development.

The impact of curtailing access to space for pharmaceutical and medical materials purification may be the stunted growth of improved health care.

You asked for comments on steps that would ensure the commercial user has adequate access to space. Commercial materials processing users of our national launch resources will focus their needs on the space shuttle. Those users will require, I think, five things:

Number one, launch and return.

Some may require deployment and revisit; and the revisit, in order to retrieve processed commercial material, must be assured.

Third, human hands-on attention, certainly during the R&D period of a user's process or product, when success is closely tied to a sensitivity for the unknown. This has always been the basic premise of a laboratory.

Fourth, continuity in payload manifesting, with flexibility.

And fifth, a reasonable, consistent launch services pricing policy for primary and secondary payloads, cargo bay, and middeck.

These comments address needs for more than just the next few years because the space shuttle will be needed in more than just servicing long staytime users on board space station. Industry will come forward with ideas to be developed that don't need 90 days or 180 days at a time on the station.

During the coming decades, when the space station is a valued resource and a necessary resource of this nation, sortie flights with the space orbiters I think will still be in demand.

Thank you, Mr. Chairman, for the opportunity to address this valuable national resource that I think is really our access to the space future.

[The prepared statement of Charles D. Walker follows:]

SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

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CHARLES D. WALKER
SPECIAL ASSISTANT TO THE PRESIDENT
FOR SPACE STATION

MCDONNELL DOUGLAS ASTRONAUTICS CO.
1225 JEFFERSON DAVIS HWY
ARLINGTON, VA 22202

STATEMENT OF

MR. CHARLES D. WALKER

SPECIAL ASSISTANT TO THE PRESIDENT FOR SPACE STATION
MCDONNELL DOUGLAS ASTRONAUTICS COMPANY

25 JULY 1986

MR. CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE. I AM CHARLES WALKER, CURRENTLY SPECIAL ASSISTANT TO THE PRESIDENT OF MCDONNELL DOUGLAS ASTRONAUTICS COMPANY, MR. JOHN YARDLEY, FOR THE SPACE STATION PROGRAM. I THINK IT IS PERTINENT TO THESE HEARINGS TO MENTION THAT I HAVE BEEN INVOLVED WITH THE DESIGN, DEVELOPMENT AND HAVE PERFORMED THE IN-ORBIT OPERATIONS WITH OUR ELECTROPHORESIS (EOS®) PHARMACEUTICAL PROCESSING SYSTEM. I APPRECIATE THIS OPPORTUNITY TO ADDRESS THE IMPACT THAT THE LOSS OF CHALLENGER WILL HAVE UPON THE COMMERCIAL USER COMMUNITY FROM OUR STANDPOINT. I WANT TO BEGIN WITH SOME BACKGROUND TO PUT OUR ASSESSMENT IN PERSPECTIVE.

THE MCDONNELL DOUGLAS CORPORATION HAS BEEN CONTINUOUSLY INVOLVED IN THIS COUNTRY'S SPACE ACTIVITIES. WE BELIEVE THAT WITH THE SPACE TRANSPORTATION SYSTEM CAME THE PROMISE AND EXPECTATION OF FREQUENT AND MORE ECONOMICAL ACCESS TO SPACE. MCDONNELL DOUGLAS UNDERSTOOD THE POTENTIAL REWARDS AND THE RISKS MANIFESTED IN THE STS.

IN 1976, THE MCDONNELL DOUGLAS ASTRONAUTICS COMPANY SUPPORTED STUDIES OF THE POTENTIAL USES OF THE STS FOR COMMERCIAL MATERIALS PROCESSING. HIGH-VALUE, FLUID PROCESSED PHARMACEUTICALS WAS THE MOST ATTRACTIVE SUCH USE. THE RESULT WAS COMPANY FUNDING OF THE NEW BUSINESS EFFORT THAT BECAME THE ELECTROPHORESIS OPERATIONS IN SPACE PROJECT (EOS). KNOWLEDGE OF THE PROCESS AND ENGINEERING SKILL WITH FLUID MECHANICS LED TO 3-DIMENSIONAL COMPUTER MODELING OF THE CONTINUOUS FLOW ELECTROPHORESIS PROCESS.

EOS
PAGE TWO

Detailed theoretical modeling was followed by empirical verification of the process with our own unique electrophoresis chamber designs. That verified model revealed that gravity limits the process throughput, or production capability, by constraining sample concentration and flow volume. It said space (i.e., the near absence of gravity) could improve throughput from 40 to 700 times. It was also revealed that gravity limits process resolution, or the potential for product purity, by causing disruptive convection currents within the process fluids. Space could improve resolution by a factor of four. By 1979 the company was prepared to fund space-based hardware and process development with a few launches underwritten by NASA.

In January 1980, NASA agreed to provide that flight support by signing the first Joint Endeavor Agreement based upon a policy to promote commercialization. As initially manifested the electrophoresis experiment was to be rack-mounted in Spacelab 3, and flown in November 1982. Spacelab was the pre-established, formalized means for proofing and developing commercializable processes. Without the conviction and foresight of the NASA personnel then involved in promoting commercial materials processing, our Continuous Flow Electrophoresis System (CFES) would have languished before its first flight. Spacelab 3 actually flew in April 1985. Instead our flight experience began in the orbiter middeck of STS-4 in June, 1982 and saw our sixth development flight in April 1985.

IN ALL SEVEN FLIGHTS HAVE BEEN COMPLETED IN THE MIDDECK. TABLE 1 SUMMARIZES THESE FLIGHTS. THE ADVANTAGE SPACE ELECTROPHORESIS PROCESSING AFFORDS HAS BEEN PROVEN: A PRODUCTIVITY IMPROVEMENT OF WELL OVER 2 ORDERS OF MAGNITUDE AND/OR PRODUCT PURITY IMPROVEMENT OF 4 TIMES THE BEST HERE ON THE GROUND. WITHOUT THE EXPERIENCE OF THESE MISSIONS WE COULD NOT HAVE CONFIDENTLY COMPLETED DESIGN OF THE LARGER PRODUCTION PROTOTYPE SYSTEM (ORBITER CARGO-BAY PAYLOAD, YET TO BE FLOWN) NOR SATISFACTORILY JUDGED THE ECONOMICS OF SPACE-BASED PHARMACEUTICAL PROCESSING.

THE EOS PROJECT'S OBJECTIVE IS THE ESTABLISHMENT OF A PROCESSING SERVICE FOR HIGH-VALUE ORGANIC MATERIALS (INITIALLY PHARMACEUTICALS). IT IS THE INTENT OF THE MDAC TO PRODUCE, PROCESS, AND MARKET MATERIALS WITH NON-AEROSPACE INDUSTRY PARTNERS WHO HAVE THE KNOWLEDGE AND WORKING EXPERIENCE WITH SELECTED PRODUCTS AND THEIR MARKETS. TO THIS END ONE PHARMACEUTICAL PRODUCT WAS SELECTED FOR COMMERCIAL PRODUCTION WITH THE ORTHO PHARMACEUTICALS CORPORATION OF JOHNSON & JOHNSON. WHILE THE WORKING AGREEMENT WITH ORTHO WAS MUTUALLY TERMINATED IN AUGUST 1985 (AS WERE LATER BUSINESS DISCUSSIONS WITH RIKER LABORATORIES IN FEBRUARY 1986) PROJECT DEVELOPMENT HAS CONTINUED AT MDAC INCLUDING BUSINESS CONTACTS AIMED AT OBTAINING THE REQUISITE PARTNER RELATIONSHIP FOR THIS FIRST PRODUCT.

IN OCTOBER 1985 THE TARGET PRODUCT FOR THE EOS PROJECT WAS PUBLICLY IDENTIFIED AS THE HORMONE ERYTHROPOIETIN (EPO). NATURALLY PRODUCED IN OUR KIDNEYS, EPO STIMULATES RED-BLOOD CELL GROWTH. FOR THIS COMMERCIAL PROJECT IT IS CREATED IN IMPURE FORM BY CULTURES OF GENETICALLY ENGINEERED TISSUE CELLS GROWING IN EARTH-BOUND FACILITIES. THE CELL CULTURES EXCRETE THE EPO INTO THEIR GROWTH MEDIA, ITSELF COMPOSED OF MANY PROTEINS AND MINERAL COMPOUNDS.

IT IS FROM THIS MEDIA THAT THE HORMONE MUST BE PURIFIED UTILIZING THE ELECTROPHORESIS PROCESS. IN PURE FORM IT WILL BE A BREAKTHROUGH TREATMENT FOR ANEMIAS, MOST IMMEDIATELY DIALYSIS PATIENTS. WE CAN'T MAKE IT AVAILABLE TODAY, BUT WE ARE MAKING PROGRESS.

THE EOS PROCESS IS IN NO WAY LIMITED TO PURIFICATION OF EPO. THE LIST OF BIOLOGICAL SUBSTANCES SUCCESSFULLY SEPARATED AND PURIFIED IN OUR EARTH-BASED AND SPACE-BASED SYSTEMS IS EXTENSIVE. CATEGORICALLY THESE SUBSTANCES INCLUDE HORMONES, ENZYMES, NUCLEIC ACIDS, INTRACELLULAR ORGANELLES, AND WHOLE CELLS. THIS ELECTROPHORESIS PROCESS HAS MANY APPLICATIONS IN PHARMACEUTICAL AND MEDICAL RESEARCH SUBSTANCE PRODUCTION. WHEN MDAC HAS REGULATORY APPROVAL AND COMMERCIAL SALES OF EPO BEGIN, WE CAN VIGOROUSLY PURSUE ADDITIONAL PRODUCTS.

HAVING COME AS FAR AS WE HAVE, WHAT DOES THE POST-CHALLENGER ERA MEAN TO THE EOS PROJECT? CERTAINLY, FLIGHT OPPORTUNITIES FOR COMMERCIAL PRODUCTION AND NEW PRODUCT DEVELOPMENT WILL BE MORE LIMITED. HOWEVER, WITH RECENT ADVANCES IN GENETIC ENGINEERING AND OUR INVESTMENT ON BIOTECHNOLOGY THE IMPACT OF THIS NEW REALITY IS NOT THREATENING THE COMMERCIAL EFFORTS' EXISTENCE TODAY. ONE YEAR AGO IT WOULD HAVE BEEN DIFFERENT. BUT NOW WE ARE CONFIDENT THAT THE COST OF PRODUCING AND PROCESSING ENOUGH EPO TO MEET U.S. MARKET DEMAND ANNUALLY IS ESSENTIALLY THE SAME WHETHER THE ELECTROPHORESIS PURIFICATION IS PERFORMED ON EARTH OR IN SPACE. THIS SAYS WE DON'T HAVE TO RELY SOLEY UPON THE SPACE LOW-GRAVITY ENVIRONMENT FOR THIS ONE PRODUCT, EPO. OTHER PHARMACEUTICAL/MEDICAL PRODUCTS WILL, FROM OUR RESEARCH EXPERIENCE, REQUIRE DIFFERENT DEGREES OF PROCESSING OR PROCESSING CONDITIONS. THE COMMERCIAL EOS EFFORT HAS AS A GOAL THE TECHNOLOGY AND PRODUCTION CAPABILITY TO UTILIZE SPACE WHEN ECONOMICALLY APPROPRIATE. SOME SUBSTANCES WILL MOST CERTAINLY REQUIRE SPACE FOR ECONOMICAL PURIFICATIONS.

But only product development will define those substances. Continuing product development will initially utilize ground-based electrophoresis with the middeck CFES verifying and refining process conditions for space production, as appropriate. The cargo-bay attached system will be the factory for large-scale product purification in space. And since the EOS cargo-bay system has multiple electrophoresis chambers it could be utilized to process more than one product simultaneously. This will effect product economics and availability quite positively.

While we have no immediate need to produce pharmaceuticals in orbit, we believe we will require the capability. For that reason we need to have the EOS production prototype system flight qualified. Two flights are included in our Joint Endeavor Agreement for this purpose. Our commerical future utilizing space requires the shuttle orbiter. Materials processing requires not only access to space, but the return of material to earth as well. The operation of the EOS production system will be automated once it is proven. But the lowest programmatic risk requires active crew member operations and evaluation during its qualification trials. And future product development cannot be undertaken without extensive human hands-on involvement with middeck systems. Flights of the middeck system for both NASA and McDonnell Douglas work need to be manifested beginning soon after shuttle flights restart.

For commercial users the opportunity for manned attendees and intervention with their work is required. This is certainly true in the R&D phase when success is closely tied to a sensitivity for the unknown. Commercialization needs consistency and yet flexibility in mission manifesting. And finally, a consistent pricing policy, not only for cargo-bay payloads, but also middeck payloads, that realistically reflects the unique manned nature of that vehicle.

TABLE 1

MISSION	DATE	OBJECTIVE	RESULTS
STS-4	6/82	• 400 TIMES GROUND THROUGHPUT (FLOW)	463 TIMES
STS-6	4/83	• 556 TIMES GROUND THROUGHPUT	718 TIMES
		• 4 TIME GROUND PURITY	4.28 TIMES
		• 2 NASA SAMPLES	SUCCESSFUL
STS-7	6/83	• EPO HORMONE DATABASE	SUCCESSFUL
		• 2 NASA SAMPLES	SUCCESSFUL
STS-8	8/83	• PANCREATIC, PITUITARY & KIDNEY LIVE CELL SEPARATIONS	SUCCESSFUL
41-D (STS-12)	8/84	• EPO HORMONE FOR CLINICAL TESTS	MATERIAL CONTAMINATED
		• PRODUCTION EQUIPMENT EVALUATION	SUCCESSFUL
51-D (STS-16)	4/85	• CONTAMINATION-FREE SEPARATION OF EPO	SUCCESSFUL
61-B (STS-23)	11/85	• EPO HORMONE FOR CLINICAL TESTS	SUCCESSFUL

Mr. **Nelson**. Charlie, you have flown three times on the shuttle, is that correct?

Mr. **Charles Walker**. Yes, sir.

Mr. **Nelson**. Were there any other electrophoresis experiments prior to, or after, during the three times that you flew?

Mr. **Charles Walker**. No, sir; not during that period of time. I might just add however, that I believe the European Space Agency and the Federal Republic of Germany are planning electrophoresis experiments on the D-2 space lab.

[The following is a proposed change of the previous answer of Mr. Charles Walker.]

No, sir; not during that period of time. But NASA flew a simpler experiment on Apollo 14 and STS-3. And then, we flew early models of the middeck equipment aboard four STS missions before I accompanied the advanced version.

The Soviet Union has been interested enough in this technology to perform over 100 experiments aboard their Salyut space stations. And they report that some of those purified materials are being utilized in pharmaceutical production now.

Mr. **Nelson**. Did they do them on the first space lab?

Mr. **Charles Walker**. No, sir.

Mr. **Nelson**. Mr. Lyons, welcome.

Mr. **Lyons**. Thank you, Mr. Chairman, and Mr Walker.

On behalf of MCI, I would like to express my gratitude for this opportunity to present our views regarding future U.S. launch plans and policy. The recent tragic events, which have virtually halted the planned launches of commercial satellites by the United States, have clouded the future of MCI's satellite telecommunications program at a very critical juncture in time.

At the time of the STS tragedy, MCI was managing a launch schedule for November 1987 on the shuttle. Now the projected date for this launch appears to be in 1991. Satellite communication systems have limited life cycles which require replenishment on a periodic basis. This makes timely availability of launch systems at predictable and competitive cost an essential element in the commercial viability of satellite communication systems. MCI has an embedded space-related investment in excess of $1 billion, and to allow the ground portion of that investment to be idled due to the lack of an available satellite would represent a major financial hardship for MCI.

MCI is not alone. The U.S. domestic satellite industry has an investment of several billion dollars in spacecraft, earth stations, operating facilities, and related communication network hardware and software. We have been very dependent upon U.S. technology and U.S. programs for the development of this industry, and for maintaining a substantial competitive lead in the international arena. This has provided significant benefits to the United States in terms of international trade and services that have supplemented the domestic benefits.

It would appear that limiting the satellite communications industry to only one U.S. launch system, as has been the practice during the last few years, has been an error. Therefore, we strongly endorse the creation of a U.S. expendable launch vehicle capability to complement the STS. The basic design and manufacture of expendable launch vehicles was pioneered and perfected by the United

States, and there are no technical obstacles to the implementation of an expendable launch vehicle capability.

We wish to stress that to provide the necessary availability of U.S. launch services for commercial programs, as well as DOD and scientific payloads, both the STS and the expendable launch systems are required. Simply switching future launch services to only an expendable system would not meet the necessary availability criteria. In most instances, the communications satellite user would prefer to rely on expendable launch vehicles; however, the availability of the STS to back up the expendable fleet and to smooth periods of peak launch activity is essential.

It is quite evident that the timely development of a viable expendable launch capability for the above applications can only come about with some form of U.S. Government support and management. We recognize that the transition to a versatile launch vehicle fleet that includes expendables as well as the STS requires careful planning and management to avoid major revisions and modifications to existing satellite common carrier's programs which could result in severe financial penalties. We are prepared to help in this process in any way that is feasible.

As a user of launch vehicles, MCI has formulated a series of requirements which we believe are essential for a commercial expendable launch vehicle for the domestic satellite communications industry. The price of the launch vehicle must be competitive with that of the foreign alternatives, otherwise, there will be no viability to the commercial offering. Moreover, the production levels and launch levels of the vehicle should be such that the user can obtain a launch in a timely fashion, meeting his specific needs.

Ideally, the range of payload weight and dimension should be accommodated on the same baseline vehicle, just as the Ariane III and Ariane IV span these range requirements in the French system, so that the maximum economies of scale can be obtained in the production of engines, tankage, avionics, and other flight components of the launch vehicles. It would also provide economies in the use of the operational launch team and a distinct reliability advantage.

The suppliers that are selected for the launch vehicles required for commercial programs should be corporations who are totally committed in terms of their baseline business to providing aerospace equipment and space-related services, single launch vehicle failure can result in the shutdown of an expendable launch vehicle program for up to a year, and can entail corrective design and manufacturing expenditures totaling in the tens of millions of dollars. As a consequence, the supplier of the service for commercial purposes must have a large financial resource and the commitment to stay in the business in spite of temporary setbacks. MCI endorses the selection of one or more of the existing launch vehicle suppliers with the established record of reliability of their engines, avionics, and structural hardware.

It is extremely important to maintain a reasonably high annual launch rate, not only for purposes of minimizing the launch costs, but also in order to maintain an active, alert, highly competent launch team to assure high quality of operational launch services. For this reason, it seems highly desirable to concentrate the commercial expendable launch vehicles into a single family, or a maximum of two families of vehicles, in order to maintain the highest feasible launch rate.

Finally, it is necessary for commercial launch vehicles to be insurable. At the present time, insurance costs are near prohibitive and there is a reasonable prospect of no insurance being available at all in the future. It is conceivable that the Government will need to play a role in the insurance area in at least the early start-up phases of the commercial expendable launch effort in order to stimulate confidence in the launch vehicles.

There are a substantial number of economic hurdles which must be met by any launch vehicle manufacturer if he is to become a commercially viable supplier of launch services. He will have to accomplish the development necessary to upgrade his vehicle; he must develop confidence that the production levels will be high enough to assure him of a competitive set of costs for both the manufacturing and operations phases; he must devise a mechanism for demonstrating to potential users of the vehicle that it is reliable; and finally, he must show that it's capable of being insured either in the marketplace or by means of a protective pool of funds.

The expendable launch vehicle families that previously existed in the United States were consciously phased out of manufacture. Moreover, in the intervening time since the expendable fleet ceased production, there has been an ongoing and evolving series of requirements related to communication satellite payloads which are beyond the capabilities of these vehicles. As a consequence, it is no longer practical to restore these vehicles to production in their prior form and expect to be competitive in today's market. A reasonable amount of development effort is necessary to upgrade those vehicles, if they were to be selected, to meet the current and future needs of the domestic communication satellite community.

With these objectives in mind, we feel that in order for the United States to produce a commercially viable expendable launch vehicle, it will be necessary for the U.S. Government to sponsor the development necessary to bring the launch vehicles to competitive stature. The Government must also serve as a user of the vehicle and thereby guarantee to the commercial entities a certain assured launch rate for a series of years. The Government should also provide quality assurance—and in that regard we support Mr. Ziegler's recommendation with respect to a national review committee—for the vehicles, and particularly for each and every new evolutionary development of the vehicles.

Finally, from the standpoint of assuring stability of launch operations and an evenhanded allocation of launch priorities, it is highly desirable that the Government provide the launch operation and that the individual launch service customer pay his incremental share of the expended manpower and facilities based on his actual usage.

Incidentally, with the exception of the requirement for the Government to procure a series of vehicles for their own use, all of the other recommendations contained are features of the existing Ariane commercial launch vehicle effort, with the French Government providing the research and development, the quality assurance, and the launch operations.

In summary, Mr. Chairman, I would like to again express my appreciation for the opportunity to present MCI's position to the subcommittee. We feel the views of MCI are representative of the satellite common carrier industry and that these views should be provided serious consideration by the Congress.

We are extremely encouraged by the interest and concern exhibited not only by your subcommittee, but also by Chairman Fuqua. The satellite communications industry recognizes that a solution to the commercial expendable launch vehicle is 3 to 5 years away and does not provide a near-term solution for meeting our business objectives. However, we feel that it is mandatory that the U.S. Government move expeditiously to adopt an accelerated program to define, stimulate, and support the development of a U.S. expendable launch vehicle.

Thank you, Mr. Chairman.

[The prepared statement of Michael T. Lyons follows:]

MCI TELECOMMUNICATIONS CORPORATION

PRESENTATION
TO THE
SUBCOMMITTEE ON
SPACE SCIENCE AND APPLICATIONS
OF THE
COMMITTEE ON
SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
JULY 25, 1986

MICHAEL T. LYONS

STATEMENT OF MICHAEL T. LYONS
VICE PRESIDENT OF SPACE RESOURCES
MCI TELECOMMUNICATIONS CORPORATION
REGARDING FUTURE COMMERCIAL EXPENDABLE LAUNCH VEHICLES

Mr. Chairman and Members of the Subcommittee:

On behalf of MCI, I would like to express my gratitude for this opportunity to present our views regarding future U.S. launch plans and policy. The recent tragic events, which have virtually halted the planned launches of commercial satellites by the U.S., have clouded the future of MCI's satellite telecommunications program at a very critical juncture in time. At the time of the STS tragedy, MCI had a launch scheduled for November, 1987 on the shuttle; now the projected date for this launch appears to be in 1991. Satellite communication systems in geostationary orbit have unique properties and features which allow access and direct linkage over very large areas. However, they have limited life cycles which require replenishment on a periodic basis. This makes the timely availability of launch systems at predictable and competitive cost an essential element in the commercial viability of satellite communication systems. By having relied on the Space Shuttle (STS) for inserting commercial payloads into orbit, we are now faced with long delays and uncertainties about our future plans for meeting business objectives and providing reliable services to our customers. MCI has an imbedded space related investment in excess of one billion dollars, and to allow the ground portion of that investment to be idled due to the lack of an available satellite would represent a major financial hardship for MCI.

MCI is not alone, the U.S. domestic satellite industry has an investment of several billions of dollars in spacecraft, earth stations, operating facilities and related communication network hardware and software. New applications are emerging in which thousands of small earth stations, located on customer premises, will be used in a variety of telecommunication modes and services which may revolutionize the industry. We have been very dependent upon U.S. technology and U.S. programs for the development of this industry, and for maintaining a substantial competitive lead in the international arena. This has provided significant benefits to the U.S. in terms of international trade and services that have supplemented domestic benefits. The present uncertainty regarding launch system availability and related costs have created serious concerns about the future.

It would appear that limiting the satellite communications industry to only one U.S. launch system, as has been the practice during the last few years, was an error. The same can be said for many government and scientific satellite system program which have also relied on the STS for launch services. All of these programs would have benefited from the existence of an alternative launch system. Therefore, we strongly endorse the creation of a U.S. expendable launch vehicle capability to complement the STS. The basic design and manufacture of expendable launch vehicles was pioneered, and perfected by the U.S., and there are no technical obstacles to the implementation of an expendable launch vehicle capability.

We wish to stress that to provide the necessary availability of U.S. launch services for commercial programs, as well as DOD and scientific payloads, both the STS and expendable launch systems are required. Simply switching future launch services to only an expendable system would not meet the necessary availability criteria. In most instances, the communications satellite users would prefer to rely on expendable launch vehicles; however, the availability of the STS to back up the expendable fleet and to smooth periods of peak launch activity is essential.

It is quite evident that the timely development of a viable expendable launch capability for the above applications can only come about with some form of U.S. government support and management. We recognize that the transition to a versatile launch vehicle fleet, that includes expendables as well as the STS, requires careful planning and management to avoid major revisions and modifications to existing satellite communications carrier's programs which could result in severe financial penalties. We are prepared to help in this process in every way that is feasible.

EXPENDABLE LAUNCH VEHICLE REQUIREMENTS

As a user of launch vehicles, MCI has formulated a series of requirements which we believe are essential for a commercial expendable launch vehicle for the domestic satellite communications industry. The price of the launch vehicle must be competitive with that of the foreign alternatives, otherwise there will be no viability to the commercial offering. Moreover, the production levels and launch levels of the vehicle should be such that the user can obtain a launch in a timely fashion, meeting his specific needs. Typically a domestic satellite user can target his requirement date for the new satellite to within 6 months.

As we look at the launch vehicle requirements now and in the future, there are really two distinct classes of domestic communication satellite payloads. These payload classes are characterized normally by weight and dimensional factors. The lower weight class satellite payloads is in the 3,000 to 3,500 lb. class for geosynchronous transfer orbit. The heavier weight payloads for the 3rd generation domestic communication satellites, are in the 5,000 to 6,500 lb. class, and have critical dimensions in excess of 10 ft., thereby requiring unusually wide launch vehicle fairings to accommodate the payload. Ideally, both ranges of payload weight and dimension could be accommodated on the same baseline vehicle (just as Ariane III and Ariane IV span these range requirements in the French system), so that the maximum economies of scale can be obtained in the production of engines, tankage, avionics and other flight components of the launch vehicles. It will also provide economies in the use of the operational launch team and a distinct reliability advantage.

The suppliers that are selected for the launch vehicles required for commercial programs, should be corporations who are totally committed in terms of their baseline business to providing aerospace equipment and space related services. MCI fears a situation in which a supplier of the launch vehicle service is exclusively in the market because of short term financial interests and would default on his obligations in the face of a series of successive technical or financial setbacks. A single launch vehicle failure can result in the shutdown of an expendable launch vehicle program for up to a year, and can entail corrective design and manufacturing expenditures totalling in the tens of millions of dollars. As a consequence, the supplier of the service for commercial purposes must have a large financial resource and the commitment to stay in the business in spite of temporary setbacks. MCI endorses selection of one or more of the existing launch vehicle suppliers with the established record of reliability of their engines, avionics, and structural hardware.

MCI feels it is extremely important to maintain a reasonably high annual launch rate, not only for the purposes of minimizing the launch costs, but also in order to maintain an active, alert, highly competent launch team to assure high quality of operational launch services. For this reason, it seems highly desirable to concentrate the commercial expendable launch vehicles into a single family or a maximum of two families of vehicles in order to maintain the highest feasible launch rate.

Finally, it is necessary for the commercial launch vehicle to be insurable. At the present time insurance costs are near prohibitive and there is a reasonable prospect of no insurance being available at all in the future. It is conceivable that the government will need to play a role, in at least the early start-up phases of the commercial expendable launch effort in order to stimulate confidence in the launch vehicles.

RECOMMENDED U.S. GOVERNMENT ROLE IN SUPPORT OF EXPENDABLE LAUNCH VEHICLES

There are a substantial number of economic hurdles which must be met by any launch vehicle manufacturer if he is to become a commercially viable supplier of launch services. He will have to accomplish the development necessary to upgrade his vehicle; he must develop confidence that the production levels will be high enough to assure him of a competitive set of costs for both the manufacturing and operations phases; he must devise a mechanism for demonstrating to potential users of the vehicle that it is reliable; and finally, he must show that its capable of being insured either in the marketplace or by means of a protective pool of funds.

The expendable launch vehicle families that previously existed in the United States, were consciously phased out as a result of a series of government policy decisions. As a consequence, the reality is that there are no longer production capabilities for these launch vehicles in existence, and a substantial amount of early investment in tooling, long lead hardware, and other production elements will be necessary for several companies to once again begin to manufacture the expendable launch vehicles. Moreover, in the intervening time since the expendable fleet ceased production, there has been an ongoing and evolving series of requirements related to communication satellite payloads which are beyond the capabilities of these vehicles. As a consequence, it is no longer practical to restore these vehicles to production in their prior form and expect to be competitive in today's market. The dimensions of the satellites and their weights have grown since the demise of the U.S. expendable launch vehicle fleet, and a reasonable amount of development effort is necessary to upgrade those vehicles, if they were to be selected, to meet the current and future needs of the domestic communication satellite community.

With these objectives in mind, we feel that in order for the U.S. to produce a commercially viable expendable launch vehicle or vehicles, it will be necessary for the U.S. government to sponsor the development necessary to bring the launch vehicles to a competitive stature. The government must also serve as user of the vehicle and thereby guarantee to the commercial entities a certain assured launch rate for a series of years. The government should also provide the quality assurance for the vehicle and particularly for each and every new evolutionary development of the vehicles. And finally, from the standpoint of assuring stability of launch operations, and an evenhanded allocation of launch priorities, it is highly desirable that the government provide the launch operation, and that the individual launch service customer pay his incremental share of the expended manpower and facilities based on his actual usage.

With the exception of the requirement for the government to procure a series of vehicles for their own use, all the other recommendations contained herein are features of the existing Ariane commercial launch vehicle effort, with the French government sponsoring the research and development, quality assurance and launch operations.

SUMMARY

Mr. Chairman, I would like to again express my appreciation for the opportunity to present MCI's position to the subcommittee. We feel that the views of MCI are representative of the satellite common carrier industry, and that these views should be provided serious consideration by the Congress. We are extremely encouraged by the interest and concern exhibited not only by your subcommittee, but also by Chairman Fuqua. The satellite communications industry recognizes that a solution to the commercial expendable launch vehicle is three to five years away and does not provide a near-term solution for meeting our business objectives. However, we feel that it is mandatory that the U.S. government move expeditiously to adopt an accelerated program to define, stimulate and support the development of a U.S. expendable launch vehicle system.

Mr. NELSON. So one of the things you're saying then is the involvement and expenditure of funds by the U.S. Government as you upgrade existing ELV's into some derivative thereof as a future ELV or ELV's launchers?

Mr. LYONS. It's absolutely essential the Government help in that, yes, sir, from my standpoint.

Mr. NELSON. All right. Mr. Logsdon—Dr. Logsdon.

Dr. LOGSDON. Thank you, Mr. Chairman.

As you noted in your opening statement, the chairman of the full committee, Mr. Fuqua, asked the American Institute of Aeronautics & Astronautics to bring together the concerned industrial stakeholders to consider the feasibility of developing a truly viable commercial and competitive U.S. ELV capability.

We were honored to be able to have that opportunity to assist the committee, and I should say at the start of my testimony it really has been a pleasure working with your staff, with Dr. Byerly and Dr. Dawson, particularly Miss Trippett, in shaping the workshop. It could not have been done without their collaboration.

Mr. NELSON. And we appreciate your sponsorship of it.

Dr. LOGSDON. It's something I hope we can do frequently for this committee and others in the future.

We did bring together 32 participants representing every element of the launch community concerned with access to and beyond low Earth orbit, except the scientific community. Unfortunately, we ran into a conflict with the COSPAR meeting and so no appropriate scientific participant was able to be with us.

Your staff members and representatives of other congressional organizations observed the workshop and I think got a tremendous amount of benefit from the frank and intense discussions that went on there.

Our particular focus was identifying options for congressional action and obtaining the views of participants regarding those options. There was no attempt to force a consensus and no recommendations, per se, flowed—came out of the workshop. However, there was general agreement on a few propositions which I want to summarize in a moment.

We have prepared a report summarizing the workshop discussions. It has been submitted both to Mr. Fuqua and to the subcommittee, and I hope that this report can be made a part of the record along with the testimony.

Indeed, one of our participants, because he was out of town, was not able to make the deadline on commenting on the report. He's put in an additional statement—this is the American Satellite Co., and I hope that, indeed, can be included along with the report.

Mr. NELSON. We welcome that as part of the record.

[See Appendix No. 1, p. 754.]

Dr. LOGSDON. First I would like to indicate those propositions which commanded widespread, although not unanimous, support among workshop participants. They included:

Highest national priority should be given to reconstituting a U.S. Government launch capability based on a mixed fleet of shuttles and ELV's. Getting both shuttles and ELV's available is the central issue. To be avoided is dependence on any one launch system for U.S. access to space.

Government policy should be designed so that ELV's can serve as the primary launch systems for current commercial and foreign payloads beyond low Earth orbit. In particular, a policy that creates no artificial incentive for commercial and foreign users to prefer the shuttle should be developed.

Even when preference is given to ELV's as launch systems—something I think you've heard from everyone here this morning—satellite owners and operators want the shuttle available as an alternate launcher in the event that an appropriate ELV is not available.

In the short run, creating a viable U.S. expendable launch vehicle capability will require some degree of Government involvement. Recent decisions by the Department of Defense to procure both large- and medium-size ELV's for its own use and by NASA to offer ELV launches as an alternative to the shuttle—in the Delta class, anyway—go a long way toward meeting that requirement, since such Federal procurements assure the existence of production lines and the active use of launch teams and facilities. Many of the participants added that a major element still missing is a clear and appropriate policy regarding shuttle use and price. Most also believed that continuing Government support of R&D needed for future launch systems will also be required.

Given the appropriate Government support such as that just described, U.S. ELV manufacturers believe they can compete in the world market.

A commercial ELV industry is not possible, our participants argued, unless the Government completes and honors agreements with the private sector regarding issues such as hardware transfer, terms of access to launch facilities and launch ranges, et cetera. These agreements have been in process for some time and high priority ought to be given to completing them if the Government policy is to provide the climate for commercial ELV industry.

Most of our participants thought the decision on whether to develop a fourth orbiter should be based on shuttle unique mission requirements, not on the basis of reducing the backlog of commercial and foreign payloads.

Underlying all of the comments was urgency, urgency to getting a positive policy framework in place, the sooner the better.

There were two lines of disagreement with these general propositions which I think are important to recognize. One is that a policy that depends on current ELV designs or their derivatives to meet the short- to medium-term requirements is likely to stifle or deter technological innovation aimed at lowering transportation costs and/or increasing reliability, particularly on the part of the new firms wishing to enter the space transportation business.

And two, that a policy that limits the use of the shuttle-to-shuttle-unique payloads and as a backup role for other launches will delay or prevent the maturity of the shuttle system, might deny users less expensive launch prices based on the real costs of providing them excess shuttle capacity, and could damage irreparably the prospects of those commercial firms that have made shuttle-dependent investments.

I will turn now to a brief summary of the policy options identified at the workshop. I can't possibly, in the time available this morning, summarize all of the views put forward with respect to those options. Hopefully, our report is an adequate summary.

We looked at a general policy framework for providing U.S.-launch services; we looked at the question of how to provide insurance; and we looked at the question of ensuring reliability. I'm going to focus on the first because I think the insurance and reliability issues have already been pretty well discussed this morning.

We looked at four options for providing launch services. A kind of spontaneous group of the owners and operators got together at the workshop, articulated their requirements—and they're in the report—for commercial launches, with NASA aggregating the market, procuring ELV's, and providing launch services.

A second option, without the comprehensive character of the first, was a return to a preshuttle situation in which NASA indeed provided most U.S.-launch services for civilian payloads, using a mixture of launch vehicles.

A third option was a commercial competition within a favorable policy framework to provide launch services.

And finally, a proposal to create a new national launch service company. A U.S. Arianespace was presented to the workshop and discussed.

Major issues with respect to one or more of these options include:

The question of whether it is desirable to give NASA control over the U.S.-mixed launch fleet for non-DOD launches. Some at the workshop thought that NASA was unlikely ever to be able or willing to provide a service to commercial users that was responsive to their requirements and that provided ELV's in preference to shuttles. Others suggested that, while giving NASA this role might not be an ideal solution, it was the most rapid and politically feasible way to make a mixed fleet available to all users of space, and required little, if any, policy experimentation.

Second was the budgetary implications of Government procuring ELV's for commercial users. If NASA were to procure ELV's through a competitive solicitation against anticipated future requirements, there would be short-term budgetary impacts. It is possible to design a pricing policy and a payment schedule that would eventually recoup all Government costs, but there seems to be no way for NASA to manage the nation's ELV fleet without near-term increases in its budget.

One participant suggested that foreign competition was more an emotional issue than a reality. Europe was unlikely to create the capacity to absorb all launch demand, and launches by the PRC and the Soviet Union, it was claimed, are not really plausible alternatives. It was noted that Japan, when the H-2 vehicle becomes available in the 1990's, might well be a formidable competitor. It was also noted, though, that a superior U.S. launch fleet is an essential element of U.S. leadership in space.

There was debate about the degree of Government involvement required. Some participants, particularly those from the ELV manufacturers, did not believe that extensive NASA involvement or a new national launch company were needed. Especially given recent Government decisions to procure various ELV's, they argued that the major missing steps were Government assurances that it would not compete with commercial launch providers and would cooperate in making available required Government facilities. Others, though, described a commercial approach as untried and argued that the possibility of business failure was real enough, that something as critical to the country as ELV availability should not be left to the private sector alone.

While many of the participants found the concept of a U.S. Arianespace attractive, most thought that the comprehensive character of the proposal and the significant amount of legislation required to create it eliminated the concept as a viable short-term option.

I think the only thing I want to say about insurance is that most participants agreed that launch insurance at acceptable cost was becoming a very scarce resource and that a lack of insurance was quite likely to be a show stopper regarding ELV commercialization. Several options were discussed but no real consensus emerged about which was the prefered insurance approach.

Bill Ziegler presented his proposals on launch reliability to the workshop. There was a great deal of support, but as he mentioned, the ELV manufacturers in particular believed that a new, independent review board was not necessary, given their very strong incentives toward reliability. They pointed out that failure investigations were extremely painful.

In closing, it is worth pointing out a fundamental problem with nascent commercial space industries, including those but not limited to those providing launch services. That problem is the sensitivity of commercial prospects in space to Government policy decisions at a time when those decisions have not yet settled into a stable pattern. There is a high level of uncertainty in any business calculation with respect to commercial space activities.

I think a cautionary tale in this regard can be drawn from the workshop contributions from various upper stage manufacturers. Those firms have based their business decisions on a Government policy that since 1972 has been articulated by four administrations and supported by seven Congresses that made the shuttle the primary launch vehicle. Now this policy is being revised and their chances of business success may be significantly diminished. As one participant suggested, elements of industry that were formerly accomplices of Government policy may now be its victims.

This is a perspective worth considering as a new Government-industry partnership in providing a viable ELV capability is developed. Yet the national need for such a capability is so great that some action is clearly required. AIAA hopes that this workshop was a useful contribution in shaping that action, and thanks the committee for the opportunity to become involved.

Thank you.

[The prepared statement of John M. Logsdon follows:]

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TESTIMONY

OF

JOHN M. LOGSDON
VICE-CHAIRMAN, PUBLIC POLICY COMMITTEE
AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS

ON

AIAA ELV WORKSHOP

PRESENTED TO

SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
JULY 25, 1986

Mr. Chairman, I am here to day to report on the results of a workshop on requirements for a U.S. expendable launch vehicle capability. That workshop was organized by AIAA in response to a request from this committee. On May 20, 1986, Chairman Don Fuqua of the Committee on Science and Technology asked AIAA Vice President for Public Policy John Clark to bring together "concerned private parties" in order "to discuss the feasibility of developing a truly viable, commercial, and competitive United States ELV [expendable launch vehicle] industry." Chairman Fuqua expressed the hope "that such an AIAA forum would bring together ELV manufacturers, commercial satellite manufacturers and owners/operators, other users of launch services (such as scientists), upper stage manufacturers, representatives from the financial and insurance communities, as well as other appropriate representatives from the space community." In response to this request, AIAA organized a June 25-27 workshop under the auspices of its Public Policy Committee; the workshop was held at Airlie House, a conference facility near Washington, D.C. Each of the groups identified in the Congressional request except for the scientific community was represented by at least two of the thirty-two participants. (Representatives of the scientific community were invited, but could not attend.) Staff members of your subcommittee and individuals from other Congressional groups participated in the workshop as observers.

The workshop was a free-flowing, often intense discussion of the issues raised in Mr. Fuqua's request. A particular focus of the workshop was identifying policy options for Congressional consideration and obtaining the views of participants regarding those options. There was no attempt to create a consensus with respect to any particular policy option. There was, however, general agreement among workshop participants on a few propositions.

A report summarizing the workshop discussions has been prepared and submitted to Chairman Fuqua and to this subcommittee. I hope that this report will be made part of the record along with this testimony. This report is intended as an accurate summary of the actual workshop discussions, and does not necessarily represent the views of AIAA or of any individual participating in the workshop.

I would first like to indicate those propositions that commanded widespread (although not necessarily unanimous) support among workshop participants. They included:

1. Highest national priority should be given to reconstituting a U.S. government launch capability based on a mixed fleet of shuttles and ELVs. Getting both shuttles and ELVs available for U.S. users is the central issue. To be avoided is dependence on any one launch system for U.S. access to space.

2. Government policy should be designed so that ELVs can serve as the primary launch systems for current commercial and foreign payloads going beyond low earth orbit. In particular, a policy that creates no artificial incentive for commercial and foreign users to prefer the shuttle to ELVs should be developed.

3. Even when preference is given to ELVs as launch systems, satellite owners/operators want the shuttle available as an alternate launcher in the event that an appropriate ELV is not available.

4. In the short-run, creating a viable U.S. expendable launch capability will require some degree of government involvement. Recent decisions by the Department of Defense to procure both large- and medium-size ELVs for its own use and by NASA to offer ELV launches as an alternative to the shuttle go a long way towards meeting that requirement, since such federal procurements assure the existence of ELV production lines and the active use of launch teams and facilities. Many of the participants added that one major element still missing is a clear and appropriate policy regarding shuttle use and price. Most also believed that continuing government support of the research and development needed for future launch systems will also be required.

5. Given appropriate government support such as that just described, some U.S. expendable launch vehicle manufacturers believe that they can compete in the world market for launch service contracts.

6. A commercial ELV industry is not possible unless the government completes and honors agreements with private sector ELV operators regarding hardware transfer, terms of access to launch facilities and launch ranges, etc. These agreements have been in process for some time. High priority ought to be given to completing them, if the policy of the federal government continues to be creating the environment within which a commercial launch vehicle industry can operate.

7. A decision on whether to develop a fourth orbiter should be based on shuttle unique mission requirements, not on the basis of reducing the backlog of commercial and foreign payloads that can be launched on ELVs as well as shuttles.

8. There is an urgency to most of the above. The sooner a positive policy framework is put in place, the better.

Those that did not agree with the general thrust of these points based their dissent on two major arguments:

1. Any policy that depends on current ELV designs or their derivatives to meet short-to-medium-term U.S. launch requirements is likely to stifle technological innovation aimed at lowering transportation costs and/or increasing reliability, particularly on the part of new firms wishing to enter the space transportation business.

2. A policy that limits the use of space shuttle to shuttle-unique payloads and a backup role for other launches will delay or prevent the shuttle from becoming a mature system, might deny users less expensive launch prices based on the real costs of providing them excess shuttle capacity, and could damage irreparably the prospects of those commercial firms that have made shuttle-dependent investments.

Policy Options Discussed

I will now turn to a brief summary of the policy options identified at the workshop and the variety of views expressed with respect to those options. Our report contains more detail on both. The workshop paid particular attention to potential government actions in three areas:

1. the general policy framework for providing U.S. launch services;

2. means for providing insurance for space activities; and

3. means for ensuring the reliability of launch systems.

Launch Service Options

Most of the workshop focused on the first of these topics. Four options received particular attention:

1. A user-oriented policy framework dealing with all aspects of commercial launches, with NASA aggregating the market, procuring ELVs, and providing launch services. This framework represented the combined views of communication satellite manufacturers, owners, and operators represented at the workshop.

2. A return to a "pre-shuttle" situation in which NASA provided most U.S. launch services for civilian payloads, using a mixture of launch vehicles.

3. Competition within a favorable policy framework to provide launch services on a commercial basis.

4. Creating a National Launch Service Company.

Major issues raised with respect to one or more of these options include:

1. The desirability of giving NASA control of the U.S. mixed launch fleet for non-DOD launches. Some thought that NASA was unlikely ever to be able or willing to provide a service to commercial users that was responsive to their requirements and that provided ELVs in preference to shuttle launches. Others suggested that, while giving NASA this role might not be an ideal solution, it was the most rapid and politically feasible way to make a mixed fleet available to all users of space, and required little if any policy experimentation.

2. The budgetary implications of government procuring ELVs for commercial users. If NASA were to procure ELVs through competitive solicitations against anticipated future requirements, there would be short-term budget impacts. While it is possible to design a pricing policy and a payment schedule that would eventually recoup all government costs, there seems to be no way for NASA to manage the nation's ELV fleet without near-term increases in its budget.

3. The importance of foreign launch competition. One participant suggested that foreign competition was "more an emotional issue" than a reality. Europe is unlikely to create the capacity to absorb all launch demand, and launches by the PRC and the Soviet Union are not really plausible alternatives for U.S. payloads. A superior U.S. launch fleet is, however, an essential element of U.S. leadership in space.

4. Degree of government involvement required to obtain a viable U.S. ELV capability. Some participants, particularly those from ELV manufacturers, did not believe that extensive NASA involvement or a new national launch company were needed. Especially given recent government decisions to procure various ELVs, they argued that the major missing steps to make a viable commercial ELV business possible were government assurances that it would not compete with commercial launch providers and would cooperate in making available required government facilities. Others described a commercial approach as "untried," and argued that the possibility of business failure was real enough so that something as critical to the country as ELV availability should not be left to the private sector alone.

While many participants found the concept of a "U.S. Arianespace," the proposed National Launch Service Company, attractive, most thought that the comprehensive character of the proposal and the significant amount of legislation required to create it eliminated the concept as a viable short-term option. There were also those that found the quasi-government and/or monopolistic aspects of the proposal unattractive.

Insurance Availability

Most participants agreed that launch insurance at an acceptable cost was becoming a very scarce resource and that lack of insurance was quite likely to be a "show stopper" regarding ELV commercialization. Two options for obtaining insurance coverage at rates approaching historical loss ratios were presented to the workshop. One required a federal initiative to create an adequate insurance provider; the other argued that a privately-organized insurance pool was feasible. There was insufficient time at the workshop to develop a detailed assessment of these two options, and no clear preference for either emerged.

Launch Reliability

The questions of insurability of space activities is intimately associated with the reliability of all phases of space operations, but particularly of the launch phase. A number of workshop participants sensed that there was a systemic problem with the reliability of current launch systems, and thus were receptive to the proposal advanced by one participant that a national review function to assure launcher reliability, and particularly the reliability of propulsion systems, be created. The argument in support of this position was that such a function should not be carried out by launcher manufacturers themselves. A single government review office (not part of NASA) would create a base of knowledgeable individuals available to conduct an independent review for satellite owners, operators, and insurers.

There was some objection, particularly from the ELV manufacturers, to the notion of a new, independent review board. Manufacturers have strong incentives toward reliability. They find failure investigations extremely painful, and they are more familiar with their launch systems than any outsiders. They pointed out that there are already multiple reviews in the process leading to the launch decision. Also, the Department of Transportation regulations require reliability assurances, but there are problems in combining promotional and regulatory requirements in the same organization.

Conclusion

In closing, it is worth pointing out a fundamental problem with nascent commercial space industries, including those based on providing launch services. That problem is the sensitivity of commercial prospects in space to government policy decisions, at a time when those decisions have not yet settled into a stable pattern. The result is a high level of uncertainty in any business calculations with respect to space activities.

A cautionary tale in this regard can be drawn from the workshop contributions from various upper stage manufacturers. Those firms based their business decisions on a government policy that since 1972 had been articulated by four administrations and supported by seven Congresses and that made the shuttle the primary U.S. launch vehicle. Now that this policy is being revised, their chances of business success may be significantly diminished. As one participant suggested, elements of industry that were formerly accomplices of government policy may now be its victims.

This is a perspective worth considering as a new government-industry partnership in providing a viable U.S. ELV capability is developed. Yet the national need for such a capability is so great that some action is clearly required. AIAA hopes that this workshop was a useful contribution in shaping that action, and thanks the Committee for the opportunity to become involved.

Mr. **Nelson**. OK. This has been terrific, and a terrific panel. You all seem to have a unanimity, that you say, first of all, it's time to get off the dime and move and get some decisions made.

Mr. **Lyons**. Yes.

Mr. **Nelson**. Mr. Lyons says "amen", and I say "amen" to that, too.

You also seem to say that—unanimously you seem to say that we want a mixed fleet, and we want this ability of a commercial capability developed with some governmental assistance so that we have a commercial launch capability of ELV's in the future.

Now, before I turn to my ranking member, Mr. Walker, let me just ask two obvious questions here.

First of all, Dr. Logsdon, you said that you think that foreign competition is more of an emotional issue than reality; you said that this sort of came out of this conference. I want to know, do you agree with that?

Dr. **Logsdon**. To the degree that there really is not capability existing in the world to absorb more payloads than are already being absorbed, yeah, I believe I agree with that, at least for the next 5 or 6 years. As I mentioned, once Japan gets a highly capable modern vehicle up, I think that they will be a competitor, and they seem to be building excess capability beyond their requirements.

The basis for the conclusion—and I think I agree with it—was believing the Europeans when they say that they are not going to make the investments to increase Ariane's capabilities beyond the current plan, perhaps 10 to 12 launches a year.

Mr. **Nelson**. By the way, Dr. Clark, we welcome you. You are accompanying Dr. Logsdon from AIAA and we appreciate your appearance here.

All right. Now, let me follow on to that. Part of this question of foreign launch competition goes to the heart of the matter, is there a glut of transponder capacity; is that true?

Dr. **Logsdon**. No, I'm the last person in the world to comment on that. But——

Mr. **Nelson**. All right. Who wants——

Dr. **Logsdon** [continuing]. Others at this table I think are well qualified to.

Mr. **Nelson**. All right. Who wants to?

Mr. Ziegler.

Mr. **Ziegler**. As far as Western Union is concerned, we have no glut. We have turned off business opportunity after business opportunity because we did not have enough transponders during the past few years.

Mr. **Nelson**. Is there anybody that disagrees with that?

Mr. **Lyons**. I guess I would shade it a little bit differently. My impression is there is an excess of capacity. As you know, our particular frequency band is KU-band. There's a slight excess now. But what we sense is people who are looking a little bit to the future and anticipating the depletion of fuel in several of the existing satellites and are beginning to come around and cause these business opportunities that Mr. Ziegler is passing up at the present time.

There are concerns because they don't see how we're going to replenish the supply of transponders in the future, in the next 2 or 3 years. So I guess we're in a transition phase between what I would characterize as a small glut and a point where we're going to have a significant depletion.

Our particular company will lose two satellites in the next 2 years in terms of its capacity.

Mr. NELSON. Mr. Savatiel.

Mr. SAVATIEL. I would agree that there is a significant C-band capacity existing in the sky today. We operate three C-band satellites which will be in service through 1995. However, the point is that people investing in satellite technology and systems for business applications want some assurance that there will be continuity in spacecraft availability. That's the concern. I perceive there is not a real glut, and with the tragedy with the *Challenger,* there has been increased interest on what's going to happen after the ones you've got up there go dead.

Mr. NELSON. OK. Now, your comments are also applicable given what has been floated about fiber optic cables being available to handle a lot of the capacity of communications. I have been to Bell Labs and I've seen the fiber optic cables there.

Tell me about that.

Mr. SAVATIEL. Well, we are—as I mentioned before, we would offer a number of different types of technologies and would hope that the appropriate technology would be used for the right application. We are putting in extensive fiber networks, as some of the other organizations at this table are, around the United States. But there are several applications which are best suited for satellite, and we believe those applications will continued to be best utilized by satellite, particularly those applications that require broadcast capability, one to many. We need to have a satellite capability integrate with the terrestrial network, so that you can provide the best kind of service to your client.

Mr. NELSON. OK. So the sum, then, of what you're saying is, there is a little bit of a glut, but you're not concerned about it; we need the launch capacity to get future satellites up because you don't think there's going to be a glut in the future, and therefore we need communications satellites up?

Mr. Alper.

Mr. ALPER. Thank you, Mr. Chairman.

Yes, I would like to buy on to that conclusion. I would also like to say that there have been a number of speakers who have commented on the need for assurance of the continuity of launches to replace existing systems, and here you're dealing with a business, where the user, in effect, does have alternative choices in most instances.

Satellites might be better suited for some applications; that only means that the cost perhaps for satellite use is lower than alternatives. But the user wants assurances that the supplier of service can continue to supply that service. And what I've heard from many of the speakers here today is that we need to have that assurance, that we can, in fact, launch these facilities, that the user can continue to get the service the way it's being provided.

Mr. NELSON. Let me describe a launch capacity scenario for you, and you tell me if any of you disagree with this, or how you would add to it.

That the Nation, perhaps through Pete Aldridge's RFP on a medium weight launch vehicle, and/or NASA encouraging the development of additional Deltas, starts to have Government participation behind ELV's. At the same time, the Air Force continues on with the development of its heavyweight ELV's as it has in the fiscal 1986 supplemental appropriations, which has now been signed into law, for additional Titan 34-4D's and the new Titan IV, which used to be called the complementary ELV, now called Titan IV. So you have a range of horses in the stable, and the Nation proceeds with the replacement orbiter, and that you have a launch policy that encourages commercial satellites on a domestic ELV industry that would rise out of this Government activity, but that you do not preclude launches on the shuttle, shuttle launches of commercial satellites that would be shuttle unique. Simultaneously, that the Nation proceeds with its research on a future vehicle or vehicles, such as the new technologies of the aerospace plane, heavy-lift vehicles in the future.

OK. That's the scenario I paint for you about launch capability for assured access to space between now and the turn of the century. Do you agree, disagree, add or subtract? Your comments.

Mr. Lyons.

Mr. LYONS. I want to express a reservation about the MLV-ELV in the sense that we don't know—we have not been quoted prices, we don't have a good comprehensive understanding of the terms and conditions under which one would be using one of those launch vehicles. And as a consequence, they may not be commercially competitive. That is just a concern I have. It is an uncertainty with regard to those.

Mr. NELSON. All right. Now, throughout all of your testimony I thought I detected that you all have concluded that this launch industry that would arise from this Government initial startup of production lines would, in fact, be commercially feasible. And you're saying you question whether or not it would?

Mr. LYONS. I'm saying I haven't gotten the evidence in terms of a nice, firm, price quote with respect to schedule and to price for the launch service that would give me the assurance that it can be accomplished.

Mr. NELSON. Well, nobody has. So what do you need to make you happy?

Mr. LYONS. Well, one of the benefits of the Airlie workshop, in which I participated, was engaging with ELV manufacturers. And we are hopefully going to come to grips in the next several weeks with them in terms of understanding their prices and the contingencies associated with them.

Mr. NELSON. Dr. Logsdon.

Dr. LOGSDON. I think your scenario has all of the broad outlines that our participants required, suggested were required. It may not yet have the details. It implies good faith cooperation between DOD and NASA on the Government side, and a set of commercial competitors on the other side, looking toward terms and conditions for access to Government-owned facilities, a pricing policy—is the Government going to pay all of the startup costs of the launch lines, and what is the price to a commercial purchaser of the *n*th medium range vehicle or the *n*th Titan IV? Those are the kind of issues that need to be worked out and I think aren't yet. But certainly the scenario that you have sketched is the one that I think emerged as the priority or majority preference of our workshop participants.

Mr. **Nelson**. OK. I appreciate that.

Then the question is, Can a domestic ELV industry arising from the scenario that we all have discussed, can it be competitive in the economic global arena? Can it compete with the Ariane, can it compete with the Chinese?

Dr. **Cheston**. I would just like to add that I do not share with some of the other opinions expressed this morning the complete comfort, that through a United States-French cartel dividing up the launches the United States ELV industry can develop without other foreign competition.

I think we're underrating the Chinese greatly. A recent visit to Beijing indicated to me that they are building their capacity, developing very attractive financial arrangements that will attract companies that are not exceptionally well capitalized to get their business.

You want to lock in for decade-long relationships that will allow not just for one launch but many launches? I just have a very uncomfortable feeling when I hear this conversation of a deja vu of being here in the 1950's, listening to the steel industry talking as if there was not going to be any other foreign competition. We could lose the whole ball of wax if we do not consider the pricing structures of foreign competitors, other than the French.

Thank you.

Mr. **Nelson**. Mr. Alper.

Mr. **Alper**. First to the general outlines of your policy, Mr. Chairman, we support them. They match many of the ideas that we've put forward, and we think it's getting into the detail, of course, which will determine whether this policy will be successful or not.

You asked can we compete. It's difficult to know without knowing the extent to which the Government is willing to assist in assuring the competitiveness of our launch vehicle industry.

We're dealing with existing expendable launch vehicles which were operational 25 and 30 years ago, and we've got to compete with the French, who have at least a decade advance in technology, and the Japanese, who are coming along with new technology. And so my view is that the question is not so much can we compete; we must compete. We must compete in order to have the leadership in launch vehicle technology that will maintain our leadership in the space business. We must be a leader in space, or the space business will not migrate and will not go offshore.

So the question begs the answer. We must be competitive. Can we be competitive with our current technology? Part of the answer to that question lies with the Government; part of it lies with industry. I really won't—I can't answer. But I believe we must attempt to be competitive with new technology in the expendable launch vehicle field.

Mr. **Nelson**. Mr. Walker.

Mr. **Robert Walker**. Thank you, Mr. Chairman.

I agree with the chairman in what he said 1 minute ago, that we have to get decisions made. I think what we've heard here today will be very useful in trying to move in that direction.

Let me say, though, that it also occurs to me that the right decisions have to be made, because we have a window of a problem here and also a window of opportunity. And it seems to me that we could make some decisions to solve short-term problems that would carry with them very long-term problems, that we can also design a long-term policy that carries with it some short-term risk. And we've got to decide which of those two directions we're going to go. And the Government, because of the role it plays, is going to be a very, very important part of that decision.

The scenario sketched for you by the chairman I'm not so certain I would buy into. We're going to be discussing this for a period of time, but let me suggest that creating a NASA monopoly for space access between now and the end of the century may not be the best long-term option for this country. It seems to me that we've got people here at the table who are looking for commercial launches. It occurs to me that maybe the best way to do commercial launching is commercially, that maybe creating private launch capacity in this country is what we need to be looking at right now, and that one way of doing that, instead of NASA buying vehicles, would be for NASA to buy services rather than vehicles. Because it occurs to me that an agency that should be doing R&D and moving toward the next generation of vehicle that is competitive with the Ariane, and better and cheaper and more efficient, ought not be spending scarce resources to buy 1950's and 1960's technology.

And if you create essentially a NASA monopoly for space access, that's what we're going to be doing. That's how we're going to be using the resources. The scenario that we may want to sketch here is one that has elements of that. Certainly we need the fourth orbiter. But it also occurs to me that we may want to have NASA essentially helping to create that kind of a commercial industry by purchasing service, going out with RFP and saying "You deliver a satellite to orbit and we pay you for that which the Government needs," and then you have a commercial industry to go to with your loads that is competitive because of the economy of scale created by Government.

Does that make any sense?

Dr. Logsdon. Certainly it was an option that many of our participants found attractive. I think I heard even Mike Lyons this morning say—I think it was Mike—that the users don't care who provides the launch; they want the launch, and they want it at the cheapest price if they're commercial.

Mr. Robert Walker. Sure.

Dr. Logsdon. So if—and I didn't hear Mr. Nelson's scenario say that it was a NASA monopoly. It said NASA bought the vehicles for Government launches and that helped a private ELV industry have the production line——

Mr. Nelson. Well, in my scenario, I didn't even say that. I said that NASA acquired launchers, and I leave open the question as to whether NASA buys the vehicles or acquires the launch services.

Mr. Robert Walker. OK. Well, I misunderstood. I took the word "acquired" as meaning that you were going to have NASA buying the vehicle.

Mr. Nelson. No, I think that's an open question. What I'm trying to do is chart a scenario to see how do we get to space.

Dr. Logsdon. And I think one of the conclusions of the workshop was that there was enough demand from Government requirements to provide most of the base to get the lines up and running.

One ELV manufacturer, by the way, said that they're perfectly prepared to pay for their own upgrades to be competitive with Ariane; they weren't looking for Government money for that. So it is these procurement decisions. As you said, maybe it's Pete Aldridge that's going to solve the problems and not 1600 Pennsylvania.

Mr. Robert Walker. It seems to me, though, that it is very important that the decisions that we make set us on a course of action where there is some stability and some continuity. My guess is that so long as you essentially have an industry that is beholding to the political process for decisions, we're going to be back here year after year after year with many of these same problems. And that the only way that you remove this from the political process is to remove some of the funding of Government in order to have an industry that's out there that will survive despite decisions of Government on funding, that we have an opportunity here to create that kind of a situation if we design the policies in a particular way.

Let me ask each of you, if the price for shuttle and the price for ELV were the same, which would you fly on?

Mr. Lyons. ELV.

Mr. Ziegler. ELV.

Mr. Robert Walker. Nearly all of you would fly ELV. Charlie, you don't have that option, right?

Mr. Charles Walker. No option.

Mr. Robert Walker. But that also says something, because the fact is that the commercial marketplace that's going to develop—you are on the leading edge of a developing commercial marketplace—is going to be absolutely shuttle dependent; whereas there are others of you who are not absolutely shuttle dependent, that could just as well go elsewhere and, in fact, would find it preferable if you could find another option than shuttle.

It seems to me that within that context we can design a policy, too, because that means then that the shuttle capacity, which could be very limited, could be reserved for those people who have real commercial loads that absolutely have to fly aboard shuttle—not foreclosing anyone, necessarily, but at least, you know, understanding within our own policy options that's true.

Do you support the proposed—I don't know whether it's a proposed idea; it's one that's been floated down the administration—of banning commercial and foreign loads on the shuttle?

Dr. Logsdon. Certainly none of our workshop participants supported that idea.

Mr. Robert Walker. OK. And I'm seeing heads shake "no" across the table, too.

In other words, you'd like to see the shuttle remain as an option for you, and if I understand correctly what I think I read in your paper, Dr. Logsdon, one thing that they would like to have is a shuttle is as kind of backup capacity, too.

Dr. LOGSDON. No, they didn't even use the word "backup". The word "alternate" was preferred.

Mr. ROBERT WALKER. OK. Alternate.

Dr. LOGSDON. And to go further, a number of people said if they knew in advance that they had U.S. ELV's and the shuttle as alternates, they would design toward at least dual capability to be launched on both, on either.

Mr. ROBERT WALKER. Just one final question.

Do any of you have an opinion on the question of commercial money being used to buy the additional orbiter? Mr. Alper.

Mr. ALPER. Mr. Walker, as I indicated in my summary, and as indicated in the testimony, we think that that's probably essential if NASA's mission is to be maintained in the science arena.

And we also, by the way, since I have the floor, think that the concept of commercialization of space launches by ELV's is an idea whose time has probably come.

Mr. ROBERT WALKER. I guess the question is—and Comsat would be one place that would have some idea of the experience. Do you think the money can be raised in the commercial sector to build an orbiter?

Mr. ALPER. We believe that it's possible. Of course, it depends on the extent to which the Government plans its launch program, because the Government will or could be the largest single customer for that.

Mr. ROBERT WALKER. Sure.

Mr. ALPER. Nevertheless, I think you have a panel among which you have a lot of users who might be interested in that approach because we're all looking toward future launches with some anxiety.

Mr. ROBERT WALKER. It is interesting that as we talk about foreign competition that while we sit and debate the issue, that the Japanese are evidently taking a look and wondering whether or not they ought to buy that fourth orbiter. You know, it seems to me that if they feel the money is there to do it, that there are an awful lot of investors across this country that may well feel that it's an investment worth making, too. But it does, again, demand that Government policy be changed in order to make that real. We're going to have to show some leadership here, we're going to have to show some leadership out of the White House, in order to get those policy changes.

I thank you very much, Mr. Chairman.

Mr. NELSON. I want to follow up, just before you leave, on that point.

I'm curious, now. If there were the private financing of an existing orbiter or a replacement orbiter, so that one of the four would be privately financed, and in order to make that economically attractive there has to be the guarantee that there be a certain ability to market commercial payloads in the space shuttle cargo bay, does that run directly into the policy that you have enunciated here today, which is that commercial satellites, first and foremost, ought to go on ELV's, not on the space shuttle?

Can you share with me your comments on that?

Yes, sir, Dr. Logsdon.

Dr. **Logsdon**. I would have to take off my AIAA hat, because you're getting me and not AIAA at this point.

Mr. **Nelson**. Please.

Dr. **Logsdon**. If there are enough payloads in Government requirements and shuttle unique requirements to justify a fourth orbiter, then the fact of Government or commercial procurement is somewhat a wash. I mean, I don't think it follows that if the commercials are going to finance the fourth orbiter they have to also be able to market to commercial users. You know, I don't think those two things are logically linked. So the question is whether it is a better deal for the Government, given the need for a fourth orbiter, to pay for it out of the budget or get it off budget by some creative financing scheme which from everything I've seen will cost the taxpayer more in the long run because of the interest payment.

Mr. **Robert Walker**. Well, if I may, I agree with that. Except when I bought my house, I sure didn't try to come up with the full amount for it when I bought it. I mean, I have gotten the use of the house now for some 15 years as a result of paying for it over that period of time, and it has increased as an asset during that period of time. The asset that we buy, that we are able to buy as a result of that kind of financing, it seems to me is the important consideration for us as a government.

On the other hand, in talking about selling commercial loads, my guess is, Charlie, that because you've got to fly aboard it and so on, and others who will follow in your footsteps have to fly aboard that kind of shuttle, that there is, in fact, some place that needs to be—that will be willing to talk to a commercial vendor who is selling loads aboard the shuttle.

You know, if that, in fact, is the case, and you've got to fly aboard the shuttle, you're going to talk to that commercial vendor whether there's an ELV industry out there or not. Isn't that true?

Mr. **Charles Walker**. That's true.

Dr. **Cheston**. Congressman, I would say one thing, that it's fairly unlikely that your house will blow up within the next 15 years. With the case of buying the shuttle, there's always that chance.

The investment community takes this risk factor very much into consideration and would demand, I think, from the Government levels of guarantees that, as Dr. Logsdon said, would probably make the shuttle considerably more expensive in the long run to the taxpayer, than the out-and-out purchase.

However, I do not feel myself or, frankly, my colleagues here to be fully informed on this subject. Probably the investment community, sending down representatives to this committee, could give you a fuller explanation on how they view it.

Mr. **Robert Walker**. Well, you know, I would agree with you that it is certainly a risk investment. I mean, that is one of the things that investors would take into account, and it would certainly be a part of some lease back agreement, and the whole insurance question plays into it. But, you know, all of us when we buy that house also take that risk. I mean, we pay the insurance and so on over and above the payments that we commit ourselves to. You know, there may be a hurricane, there may be a fire and so on in your house, too. It's certainly not the high risk that the shuttle would be, but there are a lot of high risk investments.

You know, I was interested the other day, that one of the banks that has indicated investment money is available for the shuttle is the same bank that came up with about $1.4 billion for Ted Turner to buy CBS. Now, you know, there was a risk that didn't pan out very well there, too.

But there is money that can be moved out there if, in fact, the proposition is attractive enough. The question is, I guess, whether or not this is an attractive enough proposition.

Mr. SAVATIEL. Just building, Congressman, if I may, building on your analogy of the house, I view it more as a commercial property. If the rent for the commercial property exceeds what's available in the marketplace through other places, nobody will reside in your commercial property. That's a very real risk and a very real application that may happen, that other technologies may be less costly than what we have from launching a shuttle, launching satellites via shuttle or even ELVs. So it's a concern.

Mr. ROBERT WALKER. Well, one of the things I'm concerned about is designing a policy right now, though, based upon present circumstances, that doesn't take into account the fact that the realities of some things happening exactly of the type you're talking about.

What if the commitments we make in fact run head on into aerospace plane at the turn of the century and, you know, there is virtually no market for some of these because the price drops from $2,000 a pound to $200 a pound overnight. The—you know, we've got to design a system, and it seems to me if you design a system which is commercially oriented, you somewhat take care of that impact because a commercially oriented launch system would then immediately move to buy the new technology, would immediately move into the purchase of the aerospace plane to provide that kind of capacity.

I question, based upon what I have seen here in the last few years, whether Government is going to be able to react that quickly and react that quickly to the circumstances because we always look at the politics. In whose district is it going to get built? Where are the lines going to get shut down and who's going to be out of jobs? I mean, all those things are very, very important and they're the decisions that we make, but they don't respond to a marketplace.

We're talking about here a marketplace that is rapidly developing, more rapidly than the political decisions relative to it.

Thank you, Mr. Chairman.

Mr. NELSON. Let me ask you this. We talked about, in this scenario that I painted for you, that a launch policy would be that you would not preclude commercial satellites from the shuttle where there was a shuttle-unique payload—everybody sort of nodded their head. What would you do on a further extension of that policy to say, if the shuttle had launch capacity, that you could launch the commercial satellites on the shuttle, as opposed to a policy that would say you can't have any satellites go on the shuttle unless it's shuttle-unique?

Dr. CHESTON. Congressman, I would respond——

Mr. NELSON. Dr. Cheston.

Dr. CHESTON [continuing]. From a very narrow perspective on this.

Now, we have an arrangement with NASA that provides us with payment terms that I cannot believe that a commercial ELV would be able to match. Of course, we want to go on the shuttle. In fact, we need to go on the shuttle if, indeed, the agreements are that important to us, they really are. So we are, in fact, advocating quite loudly to have commercial satellites go on the shuttle that are not shuttle unique.

Mr. NELSON. What does the domestic ELV industry say, then? Do they have any validity if they say, "Well, we can't be competitive then unless we have the guarantee that we get all of the commercial satellites on our ELV industry"?

Mr. Lyons.

Mr. LYONS. In the workshop meetings they didn't indicate they needed that. They needed—the assurance of a price indifference criteria was their concern. They did not want to be undercut by NASA and the shuttle.

I feel from our standpoint we would use the shuttle when it was timely. We're advocating a price indifference type of formula so that we really would have a technical preference for an expendable launch vehicle, but there may be schedule activities, critical downtimes on expendables, which would dicate an alternate, and that would be the shuttle.

Mr. NELSON. OK. So basically the shuttle ride for a commercial satellite would be a little more expensive than an ELV ride?

Mr. Lyons.

Mr. LYONS. I was just going to say price indifferent. I would expect it to be comparable, however——

Mr. NELSON. Comparable.

Mr. LYONS. Yes.

Mr. NELSON. Not necessarily more expensive.

Mr. LYONS. Yes.

Mr. NELSON. Dr. Logsdon.

Dr. LOGSDON. The scenario you have just painted is one that was kind of a minority view in the workshop, which said what if the shuttle becomes a fully mature system, high realiability, and it is operating with excess capacity that could be provided at real costs that are less than ELV's, should we deny that opportunity. I say that was raised as a policy question.

Sure, the ELV manufacturers would prefer absolute assurances of noncompetition, but there is that possibility downstream, once we get the system fixed, of excess shuttle capacity. That's a policy choice, I think, not a market or a technical choice.

Mr. NELSON. Okay. So you all are pretty much of a mind then that you don't want to preclude commercial satellites from the shuttle, but you want a pricing policy to operate where there is basically parity between the commercial ELV and the shuttle for your commercial satellites?

[Panel nods affirmatively.]

Everybody is shaking their head. OK, that we wanted to get nailed down.

You're a very prestigious panel. You have stimulated a lot of thinking, and I think your ideas are going to influence policy, so let's get it out and get it clear.

All right. Now, is it self-evident that we would all say—and I don't mean to ask this as a leading question, but I may as well because I think you've already expressed it—is it self-evident to say that we would certainly give a priority to shuttle-unique payloads such as the electrophoresis to fly on the shuttle? Is there any flaw in that kind of statement?

Dr. Logsdon.

Dr. LOGSDON. For people with other commercial investments and payloads, if they don't have ELV alternatives available, why should they be penalized?

Mr. NELSON. OK. All right.

Now, to what extent should commercial customers be allowed to participate in setting the manifest of what is going to go on the shuttle? Anybody? Mr. Lyons.

Mr. LYONS. One of the reasons there is a disposition to use NASA as a central source of supply for launch vehicles, ELV and the STS, was that you could go and apply for a launch, expecting to fly on an ELV, but you had a management organization which was able to put you on an alternate vehicle in the event you had a critical problem in terms of time. So you had a central authority managing the two alternatives with you, the individual customer, being relatively indifferent as to what was selected as your final launch vehicle.

Mr. NELSON. Do you think everybody ought to get together and set up a priority system among shuttle customers?

Mr. LYONS. I don't think that's practical, sir. I think that's unrealistic. I think there has to be some dictatorial authority fundamentally that determines the priority for launches.

Mr. NELSON. You said what kind of authority?

Mr. LYONS. Dictatorial, in the sense of a single authority to make that decision.

Mr. NELSON. Unless that single dictatorial authority said always that commercial users were the last in priority.

Mr. LYONS. Yes. [Laughter.]

Mr. NELSON. OK. Can we talk about the Palapa decision? All right.

There are three remaining Deltas, and the U.S. Government, at the urging of the Secretary of State, has offered to Indonesia one of those. Do you believe that this Delta hardware should be used now to leverage Government efforts to commercialize an ELV industry? In other words, as what's happened, is this a good excuse for us to have NASA start moving into an ELV-commercial derivative from the fact that it could conceivably stoke up the production of some more Deltas?

Anybody want to comment on that?

Mr. ZIEGLER. I believe the only way to get commercialization of the Delta is for NASA or DOD to order a few years supply and provide launch services with them to Delta-compatible payloads. Hopefully then some commercial entity will be able to take over.

Mr. NELSON. OK. Let's say that NASA were to order the launch services of a bunch of Deltas. To clarify with Mr. Walker's statement, let's say that the Government doesn't buy them but it orders the launch services of *x*-number of Deltas. All right, that occurs.

Then over here the Secretary of the Air Force is doing his thing with the MLV's, and his RFP has the avowed potential that it will create a domestic ELV industry.

Now, the question is, is the satellite market large enough so that it could support a possible domestic ELV industry here and one over here—two. Could it? Mr. Lyons.

Mr. LYONS. I think that's what I was expressing before. It's uncertain whether it can. My uncertainties really stem from looking at our foreign competition. Ariane has a single family of launch vehicles; that's a very economic way to go. They built a single set of engines for both the Ariane III and the Ariane IV. A lot of the parts are common. The avionics are common to both vehicles.

When you start splitting the launch operations, which doubles your expense, and splitting the number of vehicles, which increases production cost, it raises questions about whether the United States can be competitive as you spread the launch rates between several different vehicles. That is a concern that I have with respect to the scenario.

I think the scenario is good that you propose, Mr. Chairman. It is just that I still believe there are uncertainties about whether it can be really a competitive scenario without a certain amount of Government support to match the kind of support the Arianespace obtains from the French Government.

Mr. NELSON. Mr. Alper.

Mr. ALPER. I agree with Mr. Lyons' comment, but I think we also have to recognize that there is a demand for launches of the class provided by the Delta, and there is a demand for launches of the class provided by the Titan. And the Titan can't substitute—well, the Titan can substitute for the Delta, but at unreasonable cost, and Delta can't substitute for the Titan. So the demand is there for the throw weight that goes from the Delta to the Titan. The concern is whether you can get anyone to build launch vehicles on speculation, that the market will be there, absent the policy—absent one part of policy that says the Government isn't going to compete with you. This is where Arianespace has an advantage, not only the technical advantage but the advantage of the cooperation between industry and Government.

Mr. NELSON. Any more comments?

OK, let's talk about insurance. Do you think a Federal role is going to be required in users obtaining insurance? Dr. Logsdon.

Dr. LOGSDON. Well, ss I said, the workshop looked at proposals both for a Federal role and for a pooled private sector insurance capability. Strong arguments made in support of both, questions raised about both, and no clear consensus or preference emerged. So I think it's an issue that requires exploration, that there is not a straightforward or definitive answer, at least among the group of people that we brought together.

But as I said in the testimony, the one area of consensus is that there was a need for insurance, and if that wasn't solved, the rest of the thing couldn't go forward.

Mr. NELSON. OK. Well, to get insurance, you've got this spiral upward in rates right now. How do you bring it down? You could have the Government get in and start tinkering; you could have, over time, the reliability of the system start to take take hold and the panic not be there, and therefore the market supply and demand brings the rates down; or third, you could, at this point, have the satellite owners and manufacturers assume a greater degree of risk.

Tell me about this. You are the commercial users. What do you think? Should the Government do anything about this?

Dr. CHESTON. We, the satellite owners, the commercial entities that own them, are already absorbing the risk in terms of the outrageous premiums we pay. Even before the shuttle disaster, we had brushed up against the ultimate threshold, where RCA walked away from paying the premium.

My personal view is that the Government will have to become involved, that I do not see private resources available to be offering capacity now without this type of intervention. It was stretched beyond its limits before the shuttle disaster. It's even more skittish right now. And the resources have dried up and the insurance rates will continue to be extremely high, exorbitantly high, and there has to be some form of very direct Government intervention.

Mr. NELSON. Any additional comments?

Mr. ZIEGLER. We believe Ariane has offered some minimum form of insurance to take part of the risk, and the Chinese have been getting a willingness to do that, also. Why not the U.S. Government?

Mr. NELSON. Any further comments?

Mr. SAVATIEL. Mr. Chairman, we would like to support the idea of the Government chartering similar to, say, a Fannie Mae or some organization, where they guaranteed availability of insurance, and then that pool would be supported by the users and may even go commercial.

Mr. NELSON. OK.

Does the staff have any questions? Dr. Byerly. OK.

Do any of you have a concluding comment? Yes, sir, Dr. Clark. We're delighted to hear from you.

Dr. CLARK. Thank you, Mr. Chairman.

First of all I would like to thank Chairman Fuqua and yourself for providing this opportunity for AIAA to become involved in these very important policy discussions. It was a real joy to work with your staffs and I hope that this will be able to be a feasible arrangement to do other studies of this sort as time goes on. It's a very difficult time for the space program, as we all know.

I would like to take the opportunity of having the microphone to remark that I think you've had a very accurate opportunity to see the sort of constructive controversy that we were involved in during the course of the workshop, and I think this was an excellent opportunity again to air the various sides of these important issues.

I must say that as I heard the comments with regard to the Chinese Long March capabilities and Soviet capability, I too had a feeling of deja vu, but it had to do with some of the putdowns I heard with regard to the Ariane just a few years ago. I think this is something we should be very careful, any time we underestimate the resolve of these very powerful, very determined nations.

The last comment perhaps, these are extremely complex issues, and particularly in policy areas, many of the comments that you have heard today are clearly dependent upon policy issues that have not yet been determined by the agencies involved, let alone evaluated by other agencies of the Government in this political art of the possible. I believe it was H.L. Mencken that remarked that to every complex question there is a simple answer, and it's wrong. I think we should be careful.

Thank you, sir.

Mr. **Nelson**. Thank you for that wise advice.

Mr. Alper.

Mr. **Alper**. Thank you, Mr. Chairman.

Mr. Chairman, I would like to once again express our appreciation for the opportunity to present our views. I note that there is a fair degree of common ground among the panelists, and I even hear a large measure of that reflected back from the Chair, which perhaps says there's beginning to be some sort of a direction being established, at least at the first level of detail, which will obviously need to be much refined as we get into the practical implementation of whatever policy is established.

Mr. Chairman, there is a matter which we have not raised in our comments—we didn't think this was a particularly appropriate forum—and that has to do with existing commitments which are part of legislation, and in particular NASA's responsibility under the Communications Satellite Act, as amended, to launch INTELSAT satellites. I will provide the staff with a copy of a white paper we put together on that.

Otherwise, Mr. Chairman, thank you very much for this opportunity.

[See Appendix No. 4, p. 805.]

Mr. **Nelson**. Thank you very much.

Any further comments?

I might just say, in conclusion, that one of the things that Charlie Walker and I worked on together was an exciting application of use of materials processing in space other than his electrophoresis process. And that is, growing crystals in zero gravity, protein crystals. As you know, protein crystalography is a very exciting field. It's had a couple of Nobels awarded. And when you take that process to space, according to the comprehensive cancer center at the University of Alabama, you then, their theory is, have the opportunity to grow crystals larger, faster, and more pure, if you will, as you try to determine the molecular structure of those crystals to unlock the secrets in such things as cancer research.

They are just about to publish a paper which chronicles some of the experimentation that Charlie and I had the privilege of working on. It will be published in some medical journal. So again, another application of materials processing in space that could have revolutionary impact upon our society here on the face of this Earth.

Charlie.

Mr. **Charles Walker**. Mr. Chairman, at your very austute urging there, if I might follow on that point, just to make another point with regard to access to space in that regard.

The opportunity that those researchers have had to conduct that very important work would, in large part, not have been fulfilled yet, even today, if it hadn't been for some of these other commercial activities, i.e., the electrophoresis work, and the opportunity to have a researcher who could, who didn't have to run the spaceship, but had some opportunity to work with the payload, and yourself, along on the mission, to observe NASA's workings to conduct other medical research, not run the vessel, but again had time to conduct what other—research that might have been considered not just secondary but tertiary to other work going on board the shuttle. You provided—we provided them the opportunity to get that research done at an earlier opportunity than they might have formerly had the opportunity to do otherwise.

That work, I think, is certainly important, but we should recognize that without the access to space that we've had with our national space transportation system, and maybe more specifically with the people who had an opportunity to go along on it, we wouldn't even see the theory come into fruition yet and researchers having the opportunity to do this very valuable work.

Mr. **Nelson**. Thank you for your comments. It's been an excellent discussion. Thank you for your participation.

The meeting is adjourned.

[Whereupon, at 12:00 noon, the subcommittee was adjourned.]

DEVELOPING A U.S. ELV CAPABILITY

WEDNESDAY, AUGUST 13, 1986

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS,
Washington, DC.

The subcommittee met, pursuant to call, at 1:20 p.m., in room 2325, Rayburn House Office Building, Hon. Bill Nelson (chairman of the subcommittee) presiding.

Mr. NELSON. The meeting will come to order.

Let me apologize for the lateness. As you know, often what you don't plan happens, the unexpected happens, and indeed, 2 day's worth of debate on a series of about five bills they saved up the recorded votes, they started right after noon, one right after another, and have just concluded. So we are delighted to have you all here, looking forward to this hearing. And Dr. Fletcher, I understand you have a time problem and you will certainly be invited to leave if your schedule so requires after your testimony.

Let me say to everyone that we have a delegation from the People's Republic of China that is here, that I have just hosted the luncheon. And because it was an up-down kind of luncheon, with votes interspersed throughout, I have invited this delegation to come over here to the meeting. So if there is a vacant seat, I wish some of you—Are there any vacant seats over here? That's one. Would somebody over here move over here? When the delegation comes in, if there are no seats back here, then I am going to ask the Chinese delegation to come up here and sit here for their duration.

Now, today the subcommittee starts 2 very important days of hearings to discuss a potential legislative initiative to encourage the development of commercial expendable launch vehicles. This committee feels that this capability is vital for assuring access to space for this country, and assuring that we continue our leadership role in space exploration and development.

Certainly, the shuttle is America's primary means for placing men and machines and women—men generically—into orbit. Back in 1984 Congress recognized the need for alternative launch capability and for increased private sector involvement in space launch services. In that year, recognizing that need, the Commercial Space Launch Act was enacted. Since that time, little progress, unfortunately, has been made in the development of commercially viable, private sector expendable launch vehicle industries. And now, with the accident of the 28th of January, we are faced temporarily with a reduced space shuttle fleet and an extended delay in the shuttle flight program.

So, as a result of all this coming into the mix, it has brought us to this hearing and it brought us to the press conference that Mr. Walker and I had this morning, announcing the remark in the NASA authorization bill which will occur in the morning, in which we want to make sure that we have access to space in light of these changed circumstances. So we're going to take a fresh look at how legislation to remove any barriers that we find to a robust private sector launch capability.

Now, our objective here is assured access to space, and in so having that, the creation of a competitive ELV industry must spring from that national goal of assured access to space. ELV's are a means to a greater assurance of access to space. In the process of hoping that this new industry springs from—we welcome you all. Sorry we ended up with so few seats, but this is a hearing of extreme interest.

I might point out that the leader of this delegation is the Minister of Space, Mr. Deming. We welcome you, sir, indeed.

If there are a lack of seats, you are welcome to come on and sit up on there. Any of the members of the press or other audience, you're welcome to sit over here.

OK. Is everybody located?

To provide policy direction, to encourage the development of a commercial ELV industry, we will consider putting in a number of initiatives in legislation that we expect to introduce later this week. I have, in light of this, asked our witnesses to comment on these initiatives today in their testimony.

A large part of this initiative is an outgrowth of a workshop that was convened by the AIAA at the request of this committee, which brought together representatives of aerospace, ELV, communucations, and the insurance community, to discuss the requirements for the establishment of an expendable launch vehicle industry.

Now, some of those initiatives are as follows: NASA would purchase, through a competitive procurement, at least 15 launches, not vehicles, capable of placing 2,800 pounds in geosynch transfer orbit for Government payloads that are required by NASA. These launches should be purchased over a 5-year period beginning in 1988, and should occur at the rate of at least two a year, preferably three a year.

Initiative No. 2. The Commercial Space Launch Act would be amended to provide access to Government launch facilities at additive rather than direct cost.

Initiative No. 3. The shuttle pricing policy for foreign and commercial users would be amended to have the price for a shuttle launch be not less than the price for a comparable U.S. ELV launch. NASA would continue to provide incentives for research use of the shuttle through the joint endeavor agreement program. Special cost arrangements, such as deferred payments of launch cost, would be continued, when appropriate.

Initiative No. 4. To discourage NASA from active pursuit of commercial customers for the shuttle—or, in other words, putting that another way, to encourage commercial satellites to fly on expendable rockets—all revenues obtained from foreign and commercial shuttle users which exceed the full cost of providing the service would revert directly to the general fund of the U.S. Treasury. That would be all those exceeding the full costs of providing the service. Currently, that is estimated at $74 million in 1982 dollars, in the equivalent cargo bay.

Initiative No. 5. A sense-of-the-Congress statement would provide that the private insurance industry would be encouraged to establish an Underwriters Laboratory equivalent which would monitor ELV quality assurance and reliability. Such an organization would assist in more accurately assessing the risk and, thus, minimizing the risk exposure. We welcome our witnesses to assist the subcommittee in this effort.

Now, I want to tell you what occurred today. This is the second prong of a two-pronged attack. That attack in offering leadership in America's space program is starting in the morning at 9:30 with a remarkup of the NASA authorization bill. There is too much uncertainty in America's space program right now. In my personal opinion, the President has not been well served by his advisers in not getting to him for his decision critical decisions upon which we can move out with America's space program. And thus, this committee, in a bipartisan fashion, is taking that leadership initiative. Thus, tomorrow we will—we, Mr. Walker and I, the ranking member and I—will offer to the committee a suggestion through the form of an amendment in a remarkup of the NASA authorization bill to authorize for appropriations a replacement orbiter for the space shuttle Challenger, and in the process of that authorization, to use the existing hardware in our inventory of structural spares, an amount of spares that accumulate in value upwards of $400 million.

Item No. 2. To authorize for fiscal year 1987 such sums as may be necessary to be appropriated for the fixing of the problem of the joint on the SRB, a continuation of the fix that has already been provided in the funds in fiscal 1986, a supplemental appropriations bill already signed into law.

Item No. 3, an authorization of funds, as may be necessary, for the providing of ELV launch services for NASA to work off this backlog of Government payloads that it has to get up.

Item No. 4. A policy declaration that the shuttle will not be prohibited from being used for commercial payloads but that the policy is that they will fly on the expendable launch vehicles, but the shuttle will be available as a backup, or the shuttle will be available where there are unique payloads that have to fly on the shuttle.

That is the thrust of the committee. And so, in light of that, we will then follow with this policy bill which I have outlined the initiatives.

We are delighted to have a host of stellar witnesses today to help us in our deliberation. And, Dr. Fletcher, you are always welcome here. It's good to have you, and we would like for you to proceed.

STATEMENT OF JAMES C. FLETCHER, ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, ACCOMPANIED BY C. THOMAS NEWMAN, COMPTROLLER; AND ISAAC GILLAM, ASSISTANT ADMINISTRATOR FOR COMMERCIAL PROGRAMS

Dr. **Fletcher**. Mr. Chairman, this afternoon I have with me the Comptroller, Tommy Newman, whom you know, and also Ike Gillam, who is the Assistant Administrator for Commercial Programs. They will assist me in answering questions that you may have later.

I do want to thank you for your support on your proposed markup that, indeed, would help us out of a lot of our difficulties if enacted into law.

I also welcome the opportunity that you have given us to comment on the proposed legislation and, in general, the issues raised by NASA involvement in the future use of ELV's.

If you will permit me, what I would like to do is submit my statement for the record, Mr. Chairman, and then make a few remarks which are cogent to the issue. Is that all right with you?

Mr. **Nelson**. Certainly.

Dr. **Fletcher**. As you are aware, the recent accidents that have befallen the shuttle, the Titan, the Delta, and the Ariane, will create a significant backlog in overall national launch needs. I don't have to tell you that. I believe it is important to fund a new orbiter to replace the *Challenger,* as you suggested, both for overall robustness in the shuttle system, and because over the long run the shuttle will remain the most cost-effective means of satisfying our launch needs.

However, even with the replacement of the *Challenger,* the United States will have to find funding for an ELV capability to satisfy the backlog of launch needs that will be building up in the next 2 or 3 years. In this connection, I think it should be stated, but maybe goes without saying, that the recent move to remove over $500 million from the Defense Department funds that support the shuttle program is a serious step in the wrong direction, at a time when greater support for our national launch needs is urgently required.

Mr. **Nelson**. And that is now turned around, it looks like, Dr. Fletcher.

Dr. **Fletcher**. I hope so, Mr. Chairman.

Some of the backlog we are facing will involve NASA payloads, primarily those payloads planned for the science and applications programs and you are well aware of what some of those difficulties are. A lot of them are planetary programs which at the moment can only be launched by the proposed Titan IV.

The NASA Science Program is a unique and an extraordinary important national asset. Inevitably, the hiatus in launchings will affect this science program, but it is very important that we take the steps to mitigate that effect as soon as possible. For that reason, we are intensively studying the possibility of launching some of our planetary missions on the Air Force's Titan IV vehicle, which is under development. The Air Force has announced also its intention to procure medium launch vehicles, and that may also prove relevant to NASA's needs.

Finally, should the U.S. companies succeed in putting into operation a private sector launching capability, as you were discussing, we will seriously consider the use of those commercial capabilities as well.

Hence, I am generally in accord with the considerations that have motivated the proposed legislation. However, I would like to comment on a couple of specific provisions that have been suggested. To begin with, I think it may be premature to direct NASA to buy a given number of launchings in a certain limited payload category. We have a wide variety of needs, not just the ones that you suggested. We are now setting the launch needs of the entire science program and all other NASA programs over the next few years. And we hope, if we're lucky, to be able to say something about that in the next 2 or 3 weeks.

Important and complex questions of costs, schedules, and spacecraft design—we may have to redesign some of our spacecraft to fit the expendables—are all involved. At this time, NASA is not in a position to endorse any specific plan for buying launching services. We are pursuing these studies as vigorously as we can, both at NASA and, as you know, in the SIG space group, a portion of which is in the commercial space working group which you will have other members testifying this afternoon. When we have the answer to these studies, we will be glad to share them with you as soon as we do and to seek your help in implementing them.

In conclusion, Mr. Chairman, I want to thank you for the support you and the committee have given us in these very difficult times. I believe all of us have come to understand that the loss of the *Challenger* has very extensive, long-term implications that go beyond the question of how we will buy the hardware. It is very important to come to grips with these issues in a way that will preserve the strength, momentum and balance of the U.S. Space Program. I look forward in the months ahead to working with you on these issues and in seeking your help, which has been abundant in the past and which I am sure we will need in the future.

Thank you very much, Mr. Chairman.

[The prepared statement of Dr. Fletcher follows:]

Hold for Release Until
Presented by Witness
August 13, 1986

Statement of

Dr. James C. Fletcher
Administrator
National Aeronautics and Space Administration

before the

Subcommittee on Space Science and Applications
Committee on Science and Technology
U.S. House of Representatives

Mr. Chairman and Distinguished Members of the Subcommittee:

I welcome the opportunity to come before you to discuss the commercial Expendable Launch Vehicle (ELV) policy. From the outset, I want to make it clear that NASA firmly endorses the development of a U.S. private sector launch capability. Within six weeks after the 1983 National Security Decision Directive on commercial ELV's was issued, NASA had published in the **Commerce Business Daily** requests for expressions of interest for privatization of the Delta and Atlas Centaur ELV's.

In 1984, NASA entered into a preliminary agreement with Transpace Carriers, Incorporated (TCI) which transferred commercial marketing rights for the Delta vehicle to TCI. Although the last extension to that agreement expired on May 30, 1986, NASA has continued to work with TCI in their efforts to initiate private sector operations using the Delta vehicle. NASA has also been negotiating with General Dynamics regarding private operation of the Atlas Centaur launching system. These negotiations are still proceeding. In the meantime, NASA has been working as a part of the Commercial Space Working Group of the Economic Policy Council on policy issues relating to encouraging commercial launching services.

Mr. Chairman, I fully agree with the proposition that a high priority should be given to reconstituting a U.S. Government launch capability based on a mixed fleet of Shuttles and expendable launch vehicles. NASA is taking the appropriate steps, as recommended by the Rogers Commission, to return the Space Shuttle to flight status. The Department of Defense (DOD) is taking steps to reinforce its Complementary Expendable Launch Vehicle (CELV) effort and has initiated action on a Medium Launch Vehicle (MLV) activity. At the same time, several studies are underway within NASA to look at the use of ELV's for NASA payloads in Space Science and other areas. We will provide the results of these studies to the Congress when they are completed.

As you requested, the following comments are offered on your proposed commercial space launching policy legislation. We have two areas of concern relating to the proposed legislation. First, the purchase of fifteen (15) launches over a five year period may be in excess of foreseeable civil government requirements. A "quick look" indicates that there are currently only six (6) civil government missions which fit within the performance envelope specified in the proposed legislation. We will have more definitive information when our internal studies, which I mentioned earlier, are completed. It is possible that more missions will be available if the performance constraint is relaxed. A second concern in this same area is one of finding a source of funds, given our current requirements for such a procurement commitment. We, therefore, believe that NASA should not commit to a specific performance limitation or a launch rate until the overall civil needs of the government have been fully assessed.

The second area of concern is associated with the proposed legislation related to Shuttle Pricing Policy. We have, from time to time, provided to the Congress several studies relating to pricing. In each of these studies, NASA believes that it does not have legislative authority to price in excess of "full cost." If NASA were given authority to charge a price for the use of the Shuttle higher than the actual costs borne by the agency, enacted law would, of course, be followed with regard to excess reimbursements. This concern is not a major problem area and one that we believe can be resolved with appropriate legislation.

Mr. Chairman, although NASA has no specific concerns about the proposed amendment to the Commercial Space Launch Act (P.L. 98-575), it should be recognized that the application of the additive cost concept to certain launching services should not conflict or compete unfairly with similar or identical services provided by the private sector. For example, commercial payload processing facilities are available in Florida from a company called Astrotech.

Finally Mr. Chairman, NASA recognizes that the recovery of our national launching capabilities is a multifaceted problem. Expendable launch systems are an integral part of the solution to that problem. We will keep this Subcommittee informed of our internal study results as they are completed.

This concludes my formal statement. I would be pleased to answer any questions the Subcommittee may have.

Mr. NELSON. Thank you, Dr. Fletcher.

Mr. Torricelli.

Mr. TORRICELLI. Thank you, Mr. Chairman.

Mr. Chairman, let me first congratulate you for your initiative to work with the reauthorization of a replacement shuttle. I would say in all candor and frankness as well how disappointed I am that this decision comes so late. It took 25 years, Democratic and Republican administrations, to build NASA. In a matter of months, we allowed the tragedy of the shuttle to sap our spirit and to lose our initiative. This is a decision which is welcome, but it is, in any case, late. I hope the President, having now failed in giving us leadership to rebuild the shuttle and continue with the program, will quickly join us, join our chairman and join the members of this committee, to go forward. There is no time to lose.

And the real tragedy of it is, for all the time that has been lost, we never had a choice at all. There was never a question that the shuttle was going to have to be rebuilt. Those who believe star wars, those who believe in commercialization, those that believe in our intelligence-gathering capability, those that are committed to the space station, have never had a choice but to believe in rebuilding the shuttle.

Finally, at least, it appears we're about to take that first step forward. I hope this committee doesn't have to take it alone and the President will join what you, Dr. Fletcher, already know, and what this committee is about to commit itself to.

Perhaps, Dr. Fletcher, you could help me to understand the ramifications if our committee authorizes the construction of a new shuttle using the structural spares the chairman alluded to without at this time authorizing additional spending beyond the $7.6 billion. Perhaps you could explain to me the ramifications of that decision and how you see NASA proceeding.

Dr. FLETCHER. Are you suggesting that you're authorizing a funding of a fourth orbiter without an increase in the——

Mr. NELSON. No. One of the policies of tomorrow's recommendations to the committee is that the authorization for funding comes over and above the existing recommended budget, not only for the replacement shuttle but also for the fix on the SRB joints as well as the authorization for funding for the acquisition of ELV services to work off the backlog.

Mr. TORRICELLI. Perhaps, before you respond, the chairman could announce for us now, as members of the committee, at what level we're going to recommend the authorization rise to.

Mr. NELSON. The authorization is subject to appropriations. There are a number of uncertainties, that we could not come forth with a dollar figure because of the structural spares that are in, the uncertainty of the SRB fix, in the fiscal year 1987, and the question of how many ELV launches in working off the backlog. I could give you some ballparks, if you want.

Mr. TORRICELLI. If this is the message that you're going to receive from this committee, if the chairman is successful, can you tell me how you proceed from there and your reaction to that judgment, if it is made?

Dr. FLETCHER. Mr. Torricelli, I can give you my reaction. I think it's a step forward, and I think I already indicated that. Without having seen the details, I can't comment very specifically. But I do think that I have stated before, and I'll have to state it again, that depending on the amount that's authorized, we don't see how we can, as the expression goes, "eat" the orbiter from our current programs. Our current programs have already been squeezed, as you know, by the Gramm-Rudman Deficit Reduction Act, and, in addition to that, we're not sure of the costs to actually fix the anomaly, as we call it, to get flying again.

So, without having the numbers, it's hard to be specific. But I can give you a general statement. We'll use whatever we can to get that fourth orbiter procured and to get NASA back flying again.

Mr. TORRICELLI. What we're attempting to do is minimize the continued loss of time in the American Space Program. So if you receive this message from the committee tomorrow and there's an authorization for you to proceed now with a fourth orbiter, while this appropriation decision has not been made, does that end the loss of time? Can you, based on that authorization, and the money you now have in hand before an appropriations has been made, start making up for the lost time and working with contractors sufficiently in your mind?:

Dr. FLETCHER. I understand the question, Mr. Torricelli. I'll gamble an answer, but it's going to be a gamble, and that is that we will certainly give "heads up" to the appropriate contractors that are involved and get them thinking along that way, but until there's some appropriations money, we don't like to gamble too much with reprogramming money within NASA. And so, without seeing the details, I can't say how much it will help it. It would certainly save us some time because of this authorization bill.

Mr. TORRICELLI. Now, if there's a decision to proceed with a fourth orbiter, the President, if he announced a decision in the near future, is it clear in your mind yet the design on which you'll proceed? That is, how much of the recommendations of the commission for re-engineering questions—for example, escape capability—do you feel compelled to design into this fourth orbiter now, or are you able to proceed with the basics of construction and either incorporate them later during construction, or retrofit?

Dr. FLETCHER. Mr. Torricelli, we have a pretty good idea of the number of the kinds of fixes we want to make to the orbiter itself. I don't want to say it's all settled because we have a committee, as you know, from the National Academy that's reviewing all that. But, nevertheless, we have a fairly good idea what fixes are necessary to the orbiter. And I think we would certainly give—and, by the way, the principal contractor that is involved in the purchase of the fourth orbiter would probably be Rockwell International, and we would certainly alert them—we already have—on what those fixes are likely to be.

Now, in detail, there may be small changes, but I don't think those small changes, from what we now see, would make much difference in the delivery. I can't say with certainty because we haven't really finished our review of all the fixes in the fourth orbiter—in the recovery program.

Mr. TORRICELLI. But the basic construction could proceed almost immediately and changes be incorporated during construction?

Dr. Fletcher. That's my considered opinion. But only considered since you first made the announcement, Mr. Torricelli. That would be my guess I think is a better way to say it. Mr. Newman, do you want to comment further on that?

Mr. Newman. Well, I believe the basic structure, most of the line units of the orbiter would be identical to those that are in the present orbiter 104, the most recently built orbiter. So that most of that work could proceed.

Mr. Torricelli. Do we have any problem with the tooling for the shuttle? Have any of those tools been dismantled or sold, or are those still on line?

Dr. Fletcher. Mr. Torricelli, we know of no changes. There might be some detailed things that we haven't inquired about, but essentially, the tooling will be available.

Mr. Torricelli. Mr. Chairman, I'll pass at this time. I would appreciate an opportunity, after your own questions, to continue.

Mr. Nelson. OK.

The authorization that we will vote on tomorrow, just for clarification for everyone here, is an authorization for appropriations, which is the signal to proceed. It would be the intention of this committee then that we would go out and find the appropriate appropriations and, if necessary, would fight for it for all the three items that I mentioned—the fix of the SRB joints, the replacement orbiter, as well as the acquisition of ELV launches.

And it is our conclusion that for us to get back into the space business that this is what we have to do, and we can't be cowardly about it. Someone has to step forward and start it. And so, in our role as the committee of jurisdiction, we're going to do that.

Dr. Fletcher. Mr. Chairman, I can't disagree with your proposed legislation. In fact—the proposed markup, I guess I should say. In fact, I think we will need to procure some ELV's. I hope you give us the flexibility that we need to buy the right ELV's for the right programs. But I assume that will be given in the language of the bill.

Mr. Nelson. OK. Let's——

Dr. Fletcher. But let me remind you again that we still need that $500 million back from the Defense Department, which we haven't yet got back.

Mr. Nelson. Well, we're working that problem, and that looks well on the way to being solved. But we still have to work that problem.

All right. Now, let's get into some of the questions about these ELV's. First of all, rumor has had it that the administration was considering barring commercial payloads from the shuttle, and then there was a press statement to the contrary that the President had been presented with those options and that was rejected by him.

Whatever the source or the validity of the statements and/or rumors, let me just ask you, do you believe that the idea of barring commercial payloads from the shuttle is a sound one?

Dr. Fletcher. No, sir; Mr. Chairman, I do not. I made that clear in my many discussions with various parties involved. But as you know, there is a commercial space working group, which is part of the Cabinet Council, that is working that problem. I may be a lone voice in that group.

Mr. NELSON. Well, tell us, for example, your feelings of what you think the effect would be upon the U.S. communications industry if that policy were to become law?

Dr. FLETCHER. Mr. Chairman, I shouldn't comment on that specifically. But let me say that we have made good-faith contracts with people in the communications satellite business. We have signed contracts with them. They have given us earnest money, if you like. They have actually started to build some of these satellites. I think the credibility of NASA would be lost if we just arbitrarily canceled all those contracts.

Having said that, though, I think we have to cooperate with the folks that are starting a commercial ELV program and do the best we can in accommodating their needs. One of their needs is to be sure that we aren't going to compete with them in the future, that we will focus on science and military payloads perhaps at the expense of commercial payloads. That's what's being worked through the commercial space working group at the present time.

Mr. NELSON. So earlier in your statement—I just want to get you to clarify here. You are concerned about canceling customer commitments or contracts that were already made?

Dr. FLETCHER. Yes, sir, unequivocally.

Mr. NELSON. If you were required to do that, what kind of signal would that send to the industry?

Dr. FLETCHER. Well, I don't know. It would send a lot of different signals to industry. It would certainly require them, some of them, to go back to the drawing board and figure our how they're going to launch some of their satellites. At least one of them that I know of was designed specifically for the shuttle, and I don't think it would be launched on anything else. Several others were designed for the shuttle or the Ariane, so some of them would be shipped over to Ariane, assuming that Ariane is flying again. I think it would put them in somewhat of a bind, but I think that's an appropriate question to ask them.

But from our point of view, it would show lack of good faith. We haven't done that very often, Mr. Chairman. We haven't really canceled contracts that we have made in good faith, particularly where people have put money on the line to reserve a slot. Now, the accident that we had causes some problems for us as well as for them, but we would prefer not to cancel contracts and we would hope we wouldn't be asked to do so.

Mr. NELSON. Well, there would be a dollar consequence, would there not?

Dr. FLETCHER. There would be a dollar consequence, Mr. Chairman, but that's——

Mr. NELSON. There are deposits on the contracts that would have to be returned. How much would that be?

Dr. FLETCHER. I don't have that number in mind.

Mr. NELSON. Mr. Newman, how about him?

Dr. FLETCHER. Mr. Newman.

Mr. NEWMAN. Well, we have about $200 million that we have received from foreign and commercial users of the shuttle for missions we have not yet launched. Presumably, we would have to pay all of that back. I would say it's unclear as to whether they would have further claims against us for loss of revenue.

Mr. NELSON. All right, sir. Two hundred million dollars.

Let me ask you——

Dr. FLETCHER. I should add, Mr. Chairman, that rather than give you a black view of the situation, I don't think we're going to be required to cancel immediately all of our contracts. I think there will be some give, but I can't say at this point how much.

Mr. NELSON. Well, Dr. Fletcher, you may not be required to cancel any of your contracts.

Let me ask you about the use of ELV's for space station resupply. Is that a policy that is being considered by NASA now?

Dr. FLETCHER. Mr. Chairman, it's not a policy question; it's a technical question, primarily and we have looked at various resupply functions in the process of developing the space station concept. We haven't done that sort of thinking for some time now, although NASA is a big place and I'm sure there are studies going on somewhere that are looking at all kinds of expendable launch vehicles. One that I read about in Aviation Week was done by somebody down at Johnson Space Center, was thinking of a heavy lift launch vehicle of some kind which is a program on the books for NASA and the DOD but is a long way into the future.

But, by and large, having said that, I would guess in our 90-day standdown we ought to look seriously at expendables once again. The difficulty is we don't know what expendables will be available, so it's kind of hard to figure that prominently into our thinking.

Mr. NELSON. Well, what kind of performance class of ELV's would you be talking about?

Dr. FLETCHER. In the case of the space station, we would look for the largest payload we could get for the smallest cost, or the largest pounds per dollar, if you like. But there are other considerations besides just pounds per dollar. It's shape and things of that sort that come in.

Mr. NELSON. You don't have a favorite expendable in mind?

Dr. FLETCHER. No. I have heard—I think we have to wait for the outcome of the Air Force competition on medium-launch vehicles, and then I'd like to pick a favorite from among that group before I would respond.

Mr. NELSON. I might underscore that the language that you will see talked about tomorrow in the markup and subsequently in the bill that will be filed on expendables for NASA, that there is nothing in this proposal that would preclude any particular expendable rocket. So we're not locking in on a particular launch vehicle, and we want to make that clear, that——

Dr. FLETCHER. That would be helpful, Mr. Chairman.

Mr. NELSON. All right.

I'm curious, what is your thinking to this point of how you might be using these expendables for space station resupply and how that would influence the design of the space station.

Dr. FLETCHER. Mr. Chairman, as I indicated earlier, we haven't revisited the expendable problem for some months, certainly since I've been at NASA and, looking back in the history, not recently. It's only because of this standdown period, 90-day period, and some of the concerns raised by you all and others that we are looking at it again. So I really can't comment very intelligently on what kind——

Mr. **Nelson**. OK. May I assume correctly that that will be part of our discussion when we have our prayer meeting in September, when you return to the committee to report to us on your conclusions with regard to the space station?

Dr. **Fletcher**. Mr. Chairman, as you recall, I agreed to come back in September, and I hope with conclusions, but we'll give you a status report if we haven't made conclusions and we'll certainly address that problem when we come back.

Mr. **Nelson**. Does that mean that the prayer meeting occurs before the meeting or afterwards?

Dr. **Fletcher**. We're not in a position to—we're not that far along, Mr. Chairman.

Mr. **Nelson**. OK. We're going to be looking—there are a lot of people that are very expectant about that September meeting, Dr. Fletcher.

Dr. **Fletcher**. By the way, I only committed to 90 days or before, but we might be able to finish it by September. I want to make sure that's clear.

Mr. **Nelson**. Well, let me just underscore the feelings of this committee. In 90 days, the Congress is not going to be in session, from the time that the clock started ticking. The Congress, if it's in session, we're in a heap of trouble because that means we're all tied up in Gramm-Rudman and the debt limit and the debt ceiling and everything, because 90 days is somewhere around the middle of October and most Members of Congress are going to want to be back home participating in their reelection campaigns. So that's why I've tried to underscore the importance of your all coming back to us so that policy can be determined while we're still here.

Dr. **Fletcher**. With some luck, and a little optimism, we will be able to do that in September, Mr. Chairman. It's hard to say when you've started on a rethinking and a redesign of a space station to know that you can, indeed, meet that, especially when you've only been working on it, what is it, 10 days now? But we will do our best, and we will not try to play tricks or anything of that sort.

Mr. **Nelson**. Dr. Fletcher, there was an article in a publication which was quoting some rumors that there were sources within NASA saying that the Ariane and the H-2 Japanese vehicle would be considered to be used. Is this a serious consideration?

Dr. **Fletcher**. Mr. Chairman, I think it's only fair to the scientific community to look at all possibilities for launches. On the other hand—including Ariane and whatever the Japanese—I guess they call it the H vehicle. We haven't seriously done that, but depending on how we come out as a result of your legislation, and depending on how this commercial ELV program goes, I think it's only fair to consider that. I don't think we would do that, though, without coming back to your committee.

Mr. **Nelson**. Well, indeed, you know what the sentiment of this committee is——

Dr. **Fletcher**. Yes; I do.

Mr. **Nelson** [continuing]. About that, and how gnarled and complicated that issue could become, about the necessity of launching from Kennedy to reach the inclination of the space station and having foreign vehicles in that position and so forth.

Dr. **Fletcher**. I hope I wasn't misunderstood, Mr. Chairman. I didn't mean for the space station. I meant for scientific and applications-type launches, like TDRS.

Mr. **Nelson**. Although you said everything was being considered.

Dr. **Fletcher**. I meant for the scientific community.

Mr. **Nelson**. Well, let's go another question. What do you think might be the difference in cost of using ELV's vis-a-vis the shuttle for space station resupply?

Dr. **Fletcher**. Mr. Chairman, you'd be really asking me to make a wild guess on that. It really depends on the nature of the resupply and how big a payload and so forth. Quite on the average, though, it is much cheaper for us to use the shuttle as a resupply vehicle than any expendable launch vehicle that we know of. It may be that out of this competition and after a few years, that we'll see some lower cost expendable launch vehicles. But, by and large, the shuttle will win in terms of marginal costs every time, on the ones we know about. So I would say, in terms of cost, if we have a full shuttle payload, we'll always use the shuttle.

Mr. **Nelson**. All right.

Mr. Torricelli, would you like to continue any questions?

Mr. **Torricelli**. Just one, Mr. Chairman.

Mr. **Nelson**. And then you, Mr. Walker.

Mr. **Torricelli**. You said, Dr. Fletcher, the need for private businesses who were interested in entering this field, to have assurance that NASA would not be a competitor in the future.

I wonder how they would feel comfort with that NASA commitment when other nations, principally the European Space Agency, will continue to launch at clearly subsidized rates, at a similar level in any case. If there's inability to compete effectively with NASA, how was there any ability to survive in the marketplace with the Europeans? Out of deference to our friends from China, I'm not citing their own prices. But it is much the same case, or even more so.

Dr. **Fletcher**. Mr. Torricelli, don't think we haven't had a lot of discussions on that subject, and you're kind of taking my position, which I tend to agree with. But we're all guessing on the amount of subsidy that would be required for a commercial expendable launch vehicle program. We're all guessing at what the French would do. I really am not an expert on what the French will or won't do.

But if the French do not raise their prices, I think it's going to be hard to get the expendable launch vehicle, the commercial expendable launch vehicle program off the ground.

Mr. **Torricelli**. So let me just venture finally for you to make a business judgment. Even assuming best case for an American private company, that they're launching from a NASA facility, and we greatly hold down the cost of NASA's services to them, but nevertheless they're buying their own launch capability, and the Europeans continue pricing at current levels, do you have any optimism of a company being able to survive in that financial environment?

Dr. **Fletcher**. I think that's a question, Mr. Torricelli—it's a legitimate question. But there's two problems with my answer——

Mr. **Torricelli**. It's particularly a legitimate question if the administration is going to make a judgment that in any part this country's economic future in space is going to be in the hands of a variety of infant companies, only barely formed, that cannot by any measure survive in this financial environment. This is an extremely serious question for this Nation's economic and scientific future.

Dr. **Fletcher**. You bet it is, Mr. Torricelli, and I didn't mean to demean the question. It's absolutely right on target. I guess what I'm trying to say is that I already have a bias on that subject, and besides, I'm not an expert on——

Mr. **Torricelli**. I'm hoping to get you to use it.

Dr. **Fletcher** [continuing]. Commercialization of space.

But let me quickly say that it's not only a question of price; it's a question of priority. We just can't launch all of the payloads on the shuttle, even in 1995, that we have contracts to launch. We can't do it all. So some of them have to be offloaded on to something. That's what the discussion is all about in the commercial space working group.

Mr. **Torricelli**. I cannot understand the administration's frame of mind when they seem to see that this is an automatic transfer from NASA to private launchers, seemingly as if other competitors don't exist.

Dr. **Fletcher**. Yeah. But if I may just finish my thought, we do have a medium expendable launch vehicle program being initiated by the Defense Department for their own needs, I think primarily for GPS satellites. We shouldn't forget that, regardless of where the commercial expendable launch vehicle program goes, we at NASA have the option of purchasing vehicles from the Defense Department. And I hope, with your legislation, we can purchase them wherever we like in the commercial sector as well.

Mr. **Torricelli**. I thank you, Dr. Fletcher.

Thank you, Mr. Chairman.

Mr. **Nelson**. Dr. Fletcher, earlier the Secretary of State announced that the United States was offering to fly the Indonesian satellite on the Delta in 1987, and then subsequent to that you have suggested utilizing two other existing Deltas, the hardware that's being manufactured into the Deltas, to fly two other commercial satellites manifested on the shuttle; is that correct?

Dr. **Fletcher**. Mr. Chairman, I may be missing something, but the only one I know about—maybe one of them happened before I came—is the Indonesian satellite. And basically that was a Delta that had already been ordered by NASA for use by SDI, and SDI allowed us to use that for meeting our commitment which we had signed up for with the Indonesian Government. That particular satellite was scheduled to be launched on the shuttle. I may be off base. Tommy is making noises like maybe I am. But my recollection is that was a shuttle launch and we decided to meet our commitments by making that trade and going with the Delta. That, of course, isn't firmed up yet. We're still negotiating.

Mr. **Newman**. But there was a partially built Delta. There were three partially built Deltas. It would involve completion of one of those Deltas to replace the one that was borrowed for the Indonesian launch, and the Indonesians would pay the cost of the launch and of completing the Delta launch vehicle.

Mr. **Nelson**. All right, now. Let me see if I understand what we're saying. This is what we understood, and I need you to either verify or clarify or change.

That there were three Deltas in process——

Mr. **Newman**. Three Deltas that had been initiated and had been stopped in process, yes, partially built Deltas.

Mr. **Nelson**. NASA had promised those Deltas to General Abrahamson.

Dr. **Fletcher**. Not all of them. It seems like one of them was to—was it GOES——

Mr. **Newman**. We had four unlaunched Deltas which we had assigned to the GOES missions, and two other missions. Go ahead.

Dr. **Fletcher**. Ike Gillam has that answer.

Mr. **Gillam**. We had three fully built Deltas. One was to launch a second GOES mission, and we had two completed vehicles that were to go to General Abrahamson. We had three partially built Deltas that General Abrahamson's office had exercised a priority on.

Then we had eight sets of long-lead materials, or eight additional Deltas. When the Indonesian question arose, we worked an arrangement with General Abrahamson to use one of his two, the second one. We plan to use 182, one of the partially built Deltas to replace that, because it could be replaced on a schedule which would allow General Abrahamson to hold his original schedule for that second launch.

Mr. **Nelson**. OK. And after Indonesia, that left how many Deltas?

Mr. **Gillam**. Partially assembled Deltas. There are two partially assembled Deltas and there are eight sets of long leads.

Mr. **Nelson**. OK. And what do you intend with regard to those two assembled Deltas?

Mr. **Gillam**. We had two options that we were examining. General Abrahamson had requested two additional Deltas. We were also examining the option of using those two additional Deltas for additional offloads from the shuttle.

Mr. **Nelson**. In additional offloads?

Mr. **Gillam**. Additional offloads. That was an option that was being examined.

Mr. **Nelson**. What do you mean additional? Commercial satellites?

Mr. **Gillam**. Commercial satellites.

Mr. **Nelson**. OK, all right.

And since that's an option that you're considering, what is the status of your consideration?

Mr. **Gillam**. Our status of consideration is such, Mr. Chairman, that circumstances, time and events is forcing us in the direction that we will launch the Indonesian mission, and General Abrahamson's two requested missions on the partially built Deltas.

Mr. **Nelson**. And not the commercial satellites?

Mr. **Gillam**. Yes, sir.

Dr. **Fletcher**. Mr. Chairman, I don't think that's resolved yet. That's still under debate. But the chances are that what Mr. Gillam says is right.

Mr. **Nelson**. OK. The reason I raise it is an obvious one, that were you to conclude that you wanted to use those partially constructed Deltas to launch commercial satellites, does that not fly in the face of trying to build up a commercial ELV industry?

Dr. **Fletcher**. Mr. Chairman, it may or may not. You have to balance the needs of the commercial expendable launch vehicle industry versus the needs of commercial satellite people to be flown, not only commercial but scientific satellites be flown, and these are tradeoffs.

But let me quickly add that when we add up all of the needs, people that have actually put down earnest money for satellites that we were about to launch on the shuttle, it adds up to a large number, somewhere between 60 and 70—no, 50 and 60. So we're talking about 1 or 2 out of 50 or 60 at worst. Nevertheless, we would not launch any commercial satellites without coming back to this committee.

Mr. **Nelson**. Well, of course, that's the purpose of this hearing, is to determine how many additional launches of ELV's do you need to work off those backlogs and is there the viability of a commercial industry springing from the bosom of this new activity.

Dr. **Fletcher**. Mr. Chairman, I think so. There's no question about it, that there's a large number of backlogs to be worked off. As I said, between 50 and 60 that we estimate, and those are just satellites that we have earnest money for. There's a lot of others out there that we haven't got earnest money for. So I would say there's no question about that. But we're in a little bit of a political or a policy bind right now, and no priorities have been established yet on which goes first and so on.

Mr. **Nelson**. Mr. Walker.

Mr. **Walker**. Thank you, Mr. Chairman.

Just to make absolutely clear, we have no doubt at this point that NASA is fully on board with the idea that we are committed to a mixed fleet of vehicles between now and at least the turn of the century? Is that——

Dr. **Fletcher**. That's correct, Mr. Walker.

Mr. **Walker**. Therefore, the question that still probably exists is how do we manage that mixed fleet.

My question for you is, from your perspective, having looked at the issue, is NASA at this point better off buying launch services or ELV's, or acquiring the vehicles and doing the launches themselves?

Dr. **Fletcher**. Leaving out policy considerations, Mr. Walker, I think NASA is always better off buying the launch vehicles themselves, since we've been doing it for I don't know how many years, at least 15, probably more like 20 or 25, and these are old vehicles. But, nevertheless, we know them and we have upgraded them over the years. We have achieved a degree of reliability for these vehicles, and even the ones that the Air Force is likely to purchase, although there is no guarantee, they will probably be these same vehicles. So it's easiest for us to go buy them directly or—and probably less costly, because there's no middle man.

Mr. Walker. Well, OK. But I don't know that we can put policy considerations aside. For example, that's what we did before. NASA bought the vehicles. When NASA then decided that it had another vehicle, it started cancelling ELV flights. And so, as a matter of policy, NASA then moved us away from the mixed fleet concept, selling Congress on the idea that we didn't need a mixed fleet—as a matter of fact, a mixed fleet was a bad idea. So therefore, we are now left without a mixed fleet and, as a matter of policy, are having to reverse course now and go back.

Had we had some interim step of moving the ELV's into the commercial marketplace or doing something with them at that point, rather than fighting them, we might not be in a bind today. I mean, that's a policy determination that was made and at the present time, hindsight always being 20/20, it looks like it was a bad decision.

Now we're talking about coming in with a new idea of a mixed fleet, and if I hear you correctly, from the standpoint of NASA, you would like to go back to the old pattern of NASA buying the vehicles and doing the launches.

Wouldn't we be better off to have some kind of independent capacity rather than simply a NASA capacity?

Dr. Fletcher. Mr. Walker, I think the first thing I ought to say, very quickly, is that NASA is completely committed to a mixed fleet, however it comes down the pike. We, for a lot of reasons, that is our policy and I believe that's the policy of your committee and that's the policy of the executive branch. So that's not the issue. The issue is what's the best way to buy these, and from NASA's point of view, we'll buy them wherever we can. If there's a commercial launch industry out there, we'll buy them from those folks.

Mr. Walker. Well——

Dr. Fletcher. We might be able to get a bargain.

Mr. Walker. But to follow on the Chairman's question of a couple of minutes ago of Mr. Gillam, if you are buying the vehicles yourself and flying them, there never will be a commercial launch industry, because as you're saying, if you think you can do it for less and if you're in the market, there never will be a commercial launch industry that can compete with you.

Now, the point is, what kind of policy are we going to have here to assure that you are, in fact, helping to create that commercial industry rather than being an impediment to that commercial industry, because I think that has been a part of the problem in the past.

Dr. Fletcher. Well, to start with, we're not going to buy very many in the near term. Mr. Gillam talked about parts of Deltas and we have no intention at the moment to buy, as far as I can tell, more than one of those for scientific purposes. That's the end of any of our plans. So we're not talking about a very big possibility, when there are 50 or 60 that we already know about, that we have earnest money for.

Mr. Walker. Yeah, but in the near term there are a limited number of vehicles available. It's not the number of loads you can carry. There are limited number of vehicles available. Essentially, you are in the process of usurping the vehicles. There is no place for the commercial launcher or the commercial companies to get the vehicles that they need to get their business going. And that creates a problem, too.

Dr. **Fletcher**. Mr. Walker, if I may say so, the near term for us means out till 1992 or 1994. We just can't launch all of the commercial satellites, if you like that term, we can't launch all of our missions that we're committed for clear out through 1995. As I indicated, there are at least 60 that we know about, probably more when we get through, that we can't launch, that we originally had committed to launch. So that's near term for us. There's just no room on the shuttle to launch most of those satellites.

Mr. **Walker**. Yeah, I understand that. But I'm coming back to that concept question, and it really does boil down to a policy question of how we are going to help you eat into that backlog- you know, what kind of authority are you going to have in terms of reducing that backlog when it goes to either purchasing vehicles or services.

You know, while I understand what you're telling me, that NASA feels as though it can launch those vehicles cheaper than going out into the marketplace, my guess is that if the past policy is followed, that contractors are pretty much going to be the launch teams anyhow. So that the reason difference we're talking about is the administrative overhead costs and there it seems to me that administrative overhead costs probably are in favor of the commercial sector rather than the Government sector, that you begin to reduce costs substantially if you do not have to support some of the portions of Government that tend to be carried along on loads that a contractor or that a commercial industry probably would not intend to carry.

Dr. **Fletcher**. Mr. Walker, I don't disagree with you. I think we'll buy them wherever we can buy them in the least costly manner, but according to a policy which has not yet been established but which is being deliberated at the moment in the White House.

Mr. **Walker**. OK. So I think what you're telling me is if, in fact, you are asked to buy launch services rather than vehicles, you as an agency don't have a problem with that?

Dr. **Fletcher**. No.

Mr. **Newman**. If there's a supplier.

Dr. **Fletcher**. Assuming there is such a supplier, that goes without saying. But we have to keep reminding everybody that the commercial launch industry does not yet exist, but nevertheless, if it still does not exist and we need a launch vehicle of some kind——

Mr. **Walker**. Well, let's look at a specific.

What's the status of the negotiations with General Dynamics to commercialize the Atlas/Centaur?

Dr. **Fletcher**. That's on hold while we come back with this policy. We have, as you know, been negotiating with them for commercial launches, but that's on hold.

Mr. **Walker**. But didn't General Dynamics sign the agreement with NASA 2 years ago and it's you that hasn't signed?

Mr. **Gillam**. No, that's not correct, not 2 years ago. We have been negotiating for 2 years. They signed the agreement last November. Some adjustments had to be made.

Mr. **Walker**. OK. Well, so it's the better part of a year. In other words, the have signed the agreement; it's you that have held up the agreement, and for part of that time we didn't have all this reevaluation going on at the White House, and so, in fact, there has been a delay in terms of what General Dynamics could do with regard to commercializing that particular missile.

So, you know, it's true, there's no industry out there right now. But part of the problem is there's no industry there because you haven't signed the agreements to allow the industry to exist.

Dr. **Fletcher**. Mr. Walker, that's probably true, but we have to look at our problems in context with the entire needs of the country. That's what's being examined by this economics policy council at the present time. So we've just had to stand down while this debate has gone on.

Mr. **Walker**. But General Dynamics can't commercialize the Atlas/Centaur without the agreement; isn't that right?

Dr. **Fletcher**. Oh, I think there's possibly, but, you'd have to ask General Dynamics that question. But I think if they are the winner of this Air Force competition, they could very well be the commercial launch vehicle contractor of the future.

Mr. **Walker**. Well, that—But my point is that they're being held up in terms of moving toward that commercialization by the fact that you won't sign the agreement.

Dr. **Fletcher**. That's a fair statement, Mr. Walker, but the reason we can't sign it is because we're in the middle of these policy discussions and they don't want us to jump the gun before a policy is made.

Mr. **Walker**. OK. Well, I don't want us to get hung up on the chicken and the egg, that you say we can't go commercial because there's no commercial industry, while you're sitting around not signing agreements that allows the commercial industry to exist. I mean, it seems to me we get somewhat disingenuous with our arguments if we have that kind of a status that is developing.

Dr. **Fletcher**. I agree with your arguments, Mr. Walker. They're correct. It is a chicken and the egg problem, that we're sort of stuck, all of us, at the moment. I hope this will be resolved soon.

Mr. **Walker**. Thank you, Mr. Chairman.

Mr. **Nelson**. Mr. Barton, and then Mr. Volkmer.

Mr. **Barton**. Thank you, Mr. Chairman.

I just want to reiterate one thing Chairman Nelson said before we get into this subject. The hearing we had several weeks ago about some of the proposed changes with the Space Station Program, I think the committee felt like you were going to make a good faith effort and report back before the end of September. I strongly encourage you to do so. We've got a NASA authorization bill up tomorrow. There's a pretty good chance there's going to be some language in that bill that require that you do so.

I just have a few questions, Mr. Chairman. No. 1, what is the relationship, if any, between your office or your agency and the Office of Space Commercialization that's now in the Department of Transportation?

Dr. **Fletcher**. Mr. Barton, as you know, we're all part of what used to be the SIG space working group, which then got separated into two parts—the National Security Council and then a portion of the Economic Policy Council. These are all cabinet councils. The Economic Policy Council does include representatives from the office that you mentioned, as well as Commerce, as well as ourselves and DOD.

Mr. **Barton**. Well, on this issue of ELV and commercialization of ELV's, I mean, do you all work together? Do you have a relationship where you're working toward common goals, or is it a strained relationship, or is there basically no relationship other than what you have at the formal meetings that are required by—not by law, but by custom, I guess?

Dr. **Fletcher**. I would say that on one thing we're all agreed with, and that is that there should be a commercial expendable launch vehicle program, even if it costs to subsidize it, and that's the feeling of the group. And maybe the only place we have come apart or might come apart is that we, NASA, hate to cancel contracts that we've made in good faith, and I think with a little bit of luck we'll compromise so that we don't have to do that.

Mr. **Barton**. I have a document in front of me that's called Commercial Space Launch Policy, and it's a list of givens, and one of the givens is item No. 3. It says "The shuttle pricing policy for foreign and commercial users should be amended, as necessary, to have the price for a shuttle launch be not less than the price for a comparable U.S. ELV launch."

What's your opinion on that?

Dr. **Fletcher**. I have no problem with that, Mr. Barton, if the legislation could be made. At the present time, the legislation requires us to pay not higher than the costs, but if you change the legislation, we'll be glad to go along with whatever new pricing policy exists.

Mr. **Barton**. Then No. 4 says, "To discourage NASA from active pursuit of commercial customers for the shuttle, all revenues obtained from foreign and commercial shuttler users which exceed the full cost of providing the service, currently estimated at 74 million 1982 dollars, will revert directly to the general fund of the Treasury."

Dr. **Fletcher**. I have no problem with that, Mr. Barton, except the number 74 is subject to some debate. But, nevertheless, the principle I have no problem with.

Mr. **Barton**. Thank you, Mr. Chairman.

Mr. **Nelson**. Mr. Volkmer.

May I invite those folks standing up in the door—there are seven seats here and there's at least one seat over there. Would you come on—maybe two or three seats over there. Here are seven seats right here.

Mr. Volkmer.

Mr. **Volkmer**. Thank you very much, Mr. Chairman.

Dr. Fletcher, earlier this summer, when we were having oversight hearings on the shuttle, the *Challenger*, I had requested Admiral Truly to provide me and the committee with a list of the payloads, both Defense, commercial and scientific, within the next 4 years or so that we're down already, that basically had committed, and I have yet to receive those. I just talked to one of the committee staff and we have yet to receive those.

I was wondering, is there any reason why we haven't, or do you know of anything about that.

Dr. FLETCHER. Yes, I do know a lot about that, Mr. Volkmer. We have been ready with a manifest, as we call it, of payloads for the first 3 years that the shuttle flies for some weeks now. But there are two sticky issues that really have to be resolved. One has to do with the relative priorities of certain military missions, not military versus scientific, but certain military missions that only the Defense Department can resolve. The other one is what we've just been discussing. We really do have to run it by the Economic Policy Council to be sure that we're not violating any policy question which has not yet been resolved. But having said that there are these two problems, I'm optimistic that we can resolve those within the next 2 or 3 weeks. But I apologize for not being able to hand you what we had promised because I had expected to be done before now.

Mr. VOLKMER. In other words, basically everything is being held up by the decision to be made by the Economic Policy Council?

Dr. FLETCHER. A good many decisions are, Mr. Volkmer, but we still have the question of—I think most of them are of that nature. But we do have this difficult Defense Department decision which has got to be resolved. I think that can be resolved the easiest, though. It's a two-party decision.

Mr. VOLKMER. So that we can have a handle on it, some idea, couldn't we be furnished at least with the—in other words, even if there are DOD payloads that possibly use expendables and/or shuttle or what have you, couldn't we be furnished at least, not necessarily saying the manifest has to be—in other words, this one is going to fly on May 1988 and this one is going to fly on July and this one this time and that time, and whether it's an Atlas/Centaur or Titan or what, or the shuttle.

I'm not worried about what vehicle you're going to use. I'm more concerned, and I would like to have for my own information, where we are as far as payloads are concerned, not just payloads that you may decide that yes, these are the ones we'll take and the rest of you are going to have to find someplace else to go. All of them right now that you see has civilian, military, NASA payloads.

Dr. FLETCHER. Mr. Volkmer, let me make——

Mr. VOLKMER. That's different a little bit from what you told me that you were going to furnish me.

Dr. FLETCHER. I understand.

Mr. VOLKMER. I don't see any reason why you can't furnish that.

Dr. FLETCHER. Let me make a suggestion in response. First of all, you said 4 years. I would guess we could do it to a first approximation clear out to 1994. If you will permit me to suggest something, I can have Admiral Truly or one of his associates come by and sketch out the approximate manifest. But some of it has to be left vague because it's going to be a wild time when people find that they didn't make it in the first cut, and it's kind of sensitive. Until we're ready to go, we don't want to get people excited. I don't want to get into the situation I got into with the Texas delegation again, for example, where we announced things too quickly and we weren't ready. We'd rather be sure of our ground before we start getting everybody mad at us.

But I will ask him to come over——

Mr. VOLKMER. OK. Can you refer to them as potential payloads without saying "these will be the payloads"?

Dr. FLETCHER. I will ask him to do the best he can, Mr. Volkmer. That's about all I can promise.

Mr. VOLKMER. I'll probably hopefully be leaving here tomorrow—I mean Friday afternoon or Friday evening, hopefully, and I would like to have something before then, if at all possible.

I'd like to continue just a little bit with the discussion that the gentleman from Pennsylvania initiated, and the question of actually commercializing the ELV's and the potential for that. I quite agree with you, we do not have an industry at the present time. But the question is, neither do we have, in my opinion, financial resources for NASA to buy all these ELV's. I don't know where you're going to get the money.

Dr. FLETCHER. Mr. Volkmer, I think that's the question that your committee is addressing. I presume that you at least authorized the money for purchase of some of these ELV's in your markup which is soon to be forthcoming. You're quite right, we don't have it now.

Mr. VOLKMER. We can authorize it. And where are we going to take the money from in order to buy the ELV's?

Dr. FLETCHER. Mr. Volkmer, you're in a better position to answer that at the moment than I am.

Mr. VOLKMER. I haven't found a place yet. I'm just asking for help.

Dr. FLETCHER. If you're asking us to take it out of other NASA programs, at the appropriate time we'll address that problem. This particular year is not a good time. Give us our $500 million back and I can give you a better answer.

Mr. VOLKMER. What I'm trying to address the fact is that if we're going to look and go back to the old way of doing things, and with the NASA purchasing the ELV's, and then furnishing them to whoever for launches, we've got to come up with some front money, do we not?

Dr. FLETCHER. Mr. Volkmer, that's true. But I don't think that's our plan. When somebody asked us whether we might conceivably buy our own, it was for our own use, not for the use of others. The only time we would purchase ELV's for the use of others would be on the already partially built Deltas that we mentioned earlier.

Mr. VOLKMER. Right. Those would be the only ones.

Then, in other words, for commercial satellite launches, you would not be purchasing ELV's, you do not plan to purchase ELV's for those type of launches?

Dr. FLETCHER. That's correct, Mr. Volkmer.

Mr. VOLKMER. The only purchases would be for your own scientific satellites or NASA satellites?

Dr. FLETCHER. As far as current plans are concerned. But remember that we are committed to purchase Deltas for the SDI, although, quite frankly, they could purchase them directly from the contractor. But we are the intermediate there. But no commercial satellites.

I think I should reiterate that we have already purchased one for the Indonesians. I don't know whether we've actually purchased.

We've started negotiations for the purchase of an Indonesian satellite.

Mr. VOLKMER. Purchase for a Delta to launch an Indonesian satellite?

Dr. FLETCHER. That's correct, Mr. Volkmer.

Mr. VOLKMER. Now, how does that—I mean, is this going to be a new Delta? Is this one of these where we have the parts or—it's one of those. OK.

Again, I want to go back. Do you think you can work something out with the—if we're talking Delta, we're talking McDonnell-Douglas?

Dr. FLETCHER. Yes; that's correct, Mr. Volkmer.

Mr. VOLKMER. That you could work something out with them, whereby they go ahead and get the retooling back in and employees and everything, all on their own money, and start manufacturing them until the time it's ready to go, and then you pay them?

Dr. FLETCHER. There's no NASA money whatsoever in this purchase by the Indonesians, and——

Mr. VOLKMER. I'm not worried about them. I'm talking about new Deltas that you may need for——

Dr. FLETCHER. For our own purposes.

Mr. VOLKMER [continuing]. For your own purposes, down the line.

Dr. FLETCHER. If we need them for our own purposes, additional money would be required. We have no money to purchase additional ELV's for our own purposes. And we have some big problems facing us right now which we haven't resolved. The biggest one, of course, is how we launch the *Galileo* mission. If we can't launch it on the shuttle, we're faced with the problem of how we buy a Titan IV, let's say, to launch that particular mission.

Mr. VOLKMER. How much would you estimate a Delta, the newest one, would run?

Dr. FLETCHER. The Delta cost is running somewhere between $50 and $60 million, in there somewhere, Mr. Volkmer. Tom, do you have——

Mr. NEWMAN. We estimate about $50 million per vehicle launched. That is including the hardware and the cost of launching.

Mr. VOLKMER. And the cost of launch.

Mr. NEWMAN. Yes.

Mr. VOLKMER. What about the Titan?

Dr. FLETCHER. The Titan is a big question, but—for our purposes. It depends on which kind of Titan, Mr. Volkmer. But the kind that we need for planetary would be very large.

Mr. VOLKMER. For *Galileo*.

Dr. FLETCHER. $250 million, thereabouts.

Mr. VOLKMER. And we won't know for several weeks, probably, finally exactly how many of those, or if any, we will actually need?

Dr. FLETCHER. I'm afraid that's right, Mr. Volkmer. There won't be very many at 250 a crack, I can guarantee that.

Mr. VOLKMER. Also the Deltas—I mean the total ELV spectrum, how many you will actually need to supplement the shuttle capability.

Dr. FLETCHER. For planning purposes, Mr. Volkmer, I think you can bet—but I wouldn't bet too much of your own money—that we would probably not purchase more than one or, at most, two Deltas for scientific purposes, and probably not more than one Titan IV. But that's just a guess at this time.

Mr. VOLKMER. All right. Then that leads me to the next question which is, will we be able to, with the three shuttles that we have, and possibly with a fourth, that we can have operational by 1990, 1991, will we be able to handle the remaining commercial satellites?

Dr. FLETCHER. Mr. Volkmer, the answer is no, emphatically no. There's just way too many commercial satellites on the books for us to launch even the ones we're committed to, and there are a lot that we haven't committed to. As I mentioned, earnest money has been given us, but we have no contracts. So we'd be nowhere near, even with four orbiters, able to launch all of the satellites that are—that we have discussed with contractors about. But then there's a large number that we haven't discussed that were planned for other methods of launching—Ariane and so forth. So there's a large number out there that we could not possibly deal with.

Mr. VOLKMER. You've been involved basically in the Space Program for a good many years, and we haven't seen what I call a commercial industry in the ELV's, or private source. There are some of us that feel that hopefully it will come about.

Do you have any opinion basically as to whether or not that is feasible within the next several years?

Dr. FLETCHER. Mr. Volkmer, I can only give you a personal view.

Mr. VOLKMER. That's what I mean, personal.

Dr. FLETCHER. I haven't really been involved in it intimately as I should have been. But, remember, yesterday was my 3-month anniversary, so I should have paid more attention to it. But I think with the appropriate subsidies of the commercial launch vehicle industry it can be established.

Mr. VOLKMER. One of our—Mr. Chairman, if I may indulge just a moment, the Commerce Department, which has been—I mean the Transportation Department, which has been operating the ELV program in the legislation we've had before, and their testimony they say the words "Consequently, it is essential for the U.S. Government to send the industry a clear signal that will no longer insist on a Government monopoly on launching."

Dr. FLETCHER. I think we'll——

Mr. VOLKMER. We're getting there?

Dr. FLETCHER. We're getting close to sending them a clear signal, yes, Mr. Volkmer.

Mr. VOLKMER. I would anticipate perhaps that may come out in the next couple of weeks then.

Thank you, Mr. Chairman.

Mr. NELSON. Thank you, Mr. Volkmer.

Mr. Chapman, before I turn to you, let me clarify something that I thought I heard you say, Dr. Fletcher.

Did you say that this—that you can't draw up a manifest and present it to this committee as you have intended to do, and as we have requested for some number of months, until you get your instructions from the commercial space working group, which is a part of SIG space, or which is a part of that Economic Policy Council?

Dr. FLETCHER. I think a better statement is, until I've got my marching orders from the President, I can't really release that manifest. It's a very touchy subject right now and I wouldn't want to mess up the negotiations that are going on right now.

Mr. NELSON. I understand how delicate it is for you, and I just must say that you must be awfully frustrated. If you thought that you were coming back out of retirement to run NASA, and thinking that you were going to have the clear mandate to offer leadership for such things as manifests like this, and then find that you have to take direction from a group that is elsewhere in the Government, that must be very, very frustrating for you. To take orders from the President is one thing; to take orders from another group, many of whom do not have a specialty at all in space, and thus has tied up the decision and delayed decisionmaking for 6½ months, is another thing. I empathize with you in your frustrations.

Mr. Chapman.

Mr. CHAPMAN. Mr. Chairman, I have no questions at this time.

Mr. NELSON. OK. Let me ask you a couple of cleanups here.

This proposal that we're talking about in a policy bill, of acquiring—of NASA acquiring launch services to work off the backload of Government satellites, why don't you compare that proposal with the DOD proposal of the competition on the MLV, medium launch vehicle competition. In other words, is there a way that we could ensure that these two efforts would be complementary, and a second question would be should NASA and DOD be compatible but separate, or should you combine the two efforts to get economies of scale and efficiency, et cetera?

Do you have any thoughts along that line?

Dr. FLETCHER. Mr. Chairman, I can give you again a personal view on this, not having been intimately involved. I welcome the Air Force competition for the medium ELV's. But not knowing how it comes out, because there are a number of different versions involved, it's hard to say.

I think, though, having said I don't know how it's going to come out, I think it's awfully important that they know what our needs are in that competition, and that we are in the process of working with them to make sure that they understanding NASA's needs as well. This is primarily for the scientific part of NASA.

Whether your legislation, which asks us to go ahead and purchase ELV's, should be complementary or not, I think complementary is not the right word. It should be coordinated with them. I think it should, yes. But that's a personal view and again not necessarily policy.

Mr. NELSON. Lilly, no, no, no. The one that I had right here, the markup.

OK. What do you think about a sunset proposal, which would——

Mr. TORRICELLI. Are you looking for a copy of your amendments?

Mr. NELSON. Yeah, that's what I'm looking for. OK. Now I have more than I know what to do with.

What do you think about a sunset in this kind of proposal, a sunset that would free NASA to market shuttle services to the commercial community if in a period of time, say 3 to 5 years, the commercial community had not demonstrated a competitive capability to come forth with an ELV commercial enterprise?

Dr. FLETCHER. Mr. Chairman, I haven't thought very much about that. I think if you put it far enough into the future, I can't see how anybody would object. The question is when, at what date should that sunset provision be added.

Mr. NELSON. All right, that's a fair response.

Tell me about your thoughts here now. We've talked about a proposal that we've outlined, of which you would acquire launch services, a number to be determined. We have thrown out the number 15, but that's something to continue to hear comment from. And then we've heard these rumors, some of which have been reportedly disputed by or overturned by the President in the press, which was a blanket prohibition of commercial payloads on the shuttle.

If you're trying to build up a commercial ELV industry, if you had to choose, which would you prefer?

Dr. FLETCHER. If I had to build up a commercial ELV industry, and that's all I was concerned about—I would certainly do what has been proposed and require NASA to cut off all its contracts. However, I think we have a broader question here because there's more than just the commercial ELV industry. We have the commercial satellite industry, we have the commercial upper stage industry, a lot of other folks that are private, and their needs have to be concerned. I don't like to keep saying over and over again, but I think NASA has a credibility problem. If we just arbitrarily cancel contracts, or even the President requires us to, that is not a good thing to do.

Mr. NELSON. Well, over the course of these 2 days of hearings we're going to hear from all those other folks that you just mentioned about and we're looking forward to it.

Do any of the committee members have any further questions for Dr. Fletcher?

Mr. TORRICELLI. I do, one, Mr. Chairman.

Mr. NELSON. Yes, Mr. Torricelli.

Mr. TORRICELLI. I wonder, Dr. Fletcher, if you could assess for us what you see as the long-range implications in the development of a next generation and future generations in improvements of expendable launch vehicles, if we begin this dramatic move to reliance on commercial launch capabilities. There are various things to be said for the advantages of Government over industry or industry over Government in operations of commercial facilities. One of them is that they have very different requirements for long-range planning, levels of investment, and the needs of technology.

I am concerned that America's launch capability rest in private hands that are concerned with their development costs on a quarter-by-quarter basis and immediate returns, as opposed to foreign governments. They're going to be able to look generation to generation without the needs for those returns. That puts us in a real advantage. I think we understand what happens when governments compete with private industry. Private industry loses. That's the problem of betting America's future on that competition.

But an important part of that is the development of the technology. Do you share a concern that moving to the next generation we might suffer from this comparative disadvantage if we shift our reliance?

Dr. **Fletcher**. Mr. Torricelli, I think it really depends on so many factors, but let me just take a case in point. One way to reduce costs per launch is to have a very large vehicle, and the shuttle is an example of that. You can probably do a lot to improve the cost per launch by advanced technology and other things.

That leads you to a situation where you have to launch a lot of payloads on one vehicle, and the question for the private industry is how are they going to manifest that. Just like we have the problem of manifesting the shuttle. It's quite possible that they can do a better job marketing than NASA because NASA has certain limitations in that regard.

If out of this whole commercial ELV movement a larger launch vehicle comes out, and they are able to manage their manifest so that they can have a large number of payloads per launch, that in itself might involve some reasonably advance technology. Remember, which I do well, that our current expendable launch vehicles all started back in 1954. I was there. I participated in Thor, Titan, and Atlas, those three, and helped the development of those. And we're still using those basic vehicles built that long ago. And although we have upgraded them, it's kind of an incremental upgrade, if you like. We've added strap-ons and we've improved the engine a little bit and so forth. That's not a bad way to go. That's pretty much the way the Russians have moved along. But it doesn't really use new technology.

If out of this commercial ELV Program—and you may hear about one or two in the course of your hearings—a new technology, or at least something more recent than 1954 comes out, that would be a step forward.

Now, the other thing is that NASA and DOD, for its long-term needs, does need a larger cargo vehicle, we would call, that needs to be lower cost per pound. As you know, we are working on the technology that would be involved in that as a joint program with the Defense Department. But that's not going to be available until the late 1990's, so that's quite a ways in the future. We're not working on the technology for smaller vehicles, NASA is not at least.

Mr. **Nelson**. OK. There is a vote on the floor on the Brown amendment concerning ASAT. The committee will recess, and when we return we will be delighted to hear from Mr. Burnley, Deputy Secretary of the Department of Transportation.

The committee will stand in recess.

[Whereupon, the subcommittee was in recess.]

Mr. **Nelson**. The committee will resume.

Mr. Burnley, we're delighted to have you here. Welcome. Please proceed.

STATEMENT OF JAMES BURNLEY, DEPUTY SECRETARY, U.S. DEPARTMENT OF TRANSPORTATION

Mr. **Burnley**. Mr. Chairman, Secretary Dole and I want to thank you for this opportunity to express the Department's position on efforts to stimulate a vigorous commercial expendable launch vehicle industry. I am going to submit a longer statement for the record, if I may. I would like to just briefly touch upon several of the key points in our judgment.

We believe that the commercial ELV industry in this country can serve a crucial role in providing the United States and its citizens with reliable access to space. While the Government has got to have a role in stimulating the growth of that industry to compete with the subsidies that some other countries are offering their ELV systems, our most important task we believe will be to stay out of the industry's way and to unleash the forces of the free market in this area.

Recognizing the contribution that ELV technology and its industrial base has made in the past and will make in the future to America's preeminence in space, the President and the Congress, with your leadership, laid the groundwork for an independent commercial ELV industry, as you know, back in 1983 and 1984. Since that initial decision, the Department of Transportation has worked to develop the regulatory framework for commercial space launch operations. This fall, we plan to complete our licensing guidelines. We have continued steady research to support safety standards, including the development of third party liability requirements. We believe now, though, that additional steps, as you have said today, must be taken to provide a climate in which a U.S. commercial ELV industry can develop and take its place in the international marketplace.

Now, as we all know, painfully, it will be 1988 before the shuttle fleet is operational again, and when the shuttle does begin flying, it obviously will be at a much more conservative launch rate. That, as Dr. Fletcher has testified today, creates a backlog that will be with us well into the 1990's and, if not managed properly, could delay other critical NASA missions such as the space station.

Fortunately, however, this country can tap the private sector to augment its crippled launch program with highly reliable unmanned rockets and well established manufacturers and launch teams. Newly built commercial ELV's will enable us to fly off the backlog at a much more rapid pace than would otherwise be possible. In fact, by the early 1990's, we believe that the hard core of the industry—the established, large manufacturers—could themselves supply up to 41 launches per year, including 10 Deltas, 17 Atlases, and up to 14 Titans. While demand may not warrant that full production capability being used, each of the responsible companies feels it can compete successfully with the subsidized foreign operators. And as you have alluded to, you will have witnesses from those companies and I will let them speak for themselves on those points.

Some of the missions, Mr. Chairman, scheduled to fly in the next 6 to 10 years clearly require a manned presence or the unique capabilities of the shuttle. But other payloads can, we all agree, be flown on ELVs. As you know, the Department of Defense has already taken steps to launch some of the backlogged national security missions on ELVs. As another part of the Administration's effort to develop a strategy for recovering from the *Challenger* accident, the Administration is taking a close look at what other payloads could be launched on unmanned vehicles. Our efforts, we believe, will bring about a balanced transition to a mixed fleet of manned and unmanned vehicles with greater reliance on private sector services.

Now, we all agree that only a mixed fleet of manned and unmanned vehicles will ensure reliable access. But we must reserve, we think, our most limited, and therefore most valuable, resource, the shuttle, for those activities that require its special capabilities.

Now, the elements for commercial success exist, and they have led major aerospace firms in this country to conclude that the industry can be profitable. Two factors have inhibited the development of this industry, however. And first, as you have alluded to today, the first factor that's been a major problem has been the Government's historic role in dominating the space launch business by assuming all the risk and paying all the bills. The second factor we believe is that the industry has been unable to compete with heavily subsidized U.S. Government systems. Consequently, it is essential for the U.S. Government we think to send the industry a clear signal that it will no longer insist on a Government monopoly.

We believe that an active and profitable commercial space transportation industry can develop in the very near future. On the other hand, any further delay in adjusting U.S. Government policies will leave this business wide open to foreign launch services and leave the United States at a dangerous disadvantage while the shuttle program is still recovering.

Now, in response, Mr. Chairman, to the committee's proposed legislative initiatives—and I'm referring to those that had been tabled some days ago, not to the further initiatives you unveiled this morning at the present conference, because we really haven't, as you would expect, had a chance to reflect upon those. Looking at those earlier initiatives, we would offer the following particular comments:

While the U.S. Government is not and should not be in the practice of reneging on contracts, the worst, most unrealistic message the Government can send the satellite industry is that shuttle launch capacity will exist to carry all preaccident payloads for which a commitment of some sort was made. And as you know, those commitments vary dramatically. By NASA's estimate, that capability, even assuming that a replacement orbiter is built in the very near future, simply does not exist on the shuttle. In light of the situation, the Administration is formulating a final policy for fulfilling these commitments. A few payloads, as I said before, are shuttle-unique, but most can be adapted to ELV's.

Second, the committee's 1984 action to encourage the use of national ranges by charging direct cost to commercial users was a valuable contribution, we think. It is unclear to us what is accomplished by substituting the word "additive." Again, we think a clear, understandable Government policy is what the ELV industry needs most.

Third, the Government's ability to exploit the opportunities that space provides has been constrained clearly by the *Challenger* accident. Additional launch capacity is obviously going to be required as a complement to the shuttle fleet. But we agree with Dr. Fletcher's judgment that he expressed here earlier this afternoon, that it would be a mistake to legislate numbers of vehicles required to launch Government payloads, and we further advocate that to spur the development of a commercial industry, NASA meet its requirements by relying on commercial launch operators and not seek to develop its own ELV fleet.

Again, I want to commend the committee for developing creative approaches to stimulate a private sector launch industry. Secretary Dole and I look forward to working very closely with this committee to develop this industry as a critical element in our space program.

I'll be happy to answer any of the committee's questions.

[The prepared statement of Mr. Burnley follows:]

Statement of

James Burnley
Deputy Secretary, U.S. Department of Transportation

before the

Subcommittee on Space Science and Applications
Committee on Science and Technology
U.S. House of Representatives

August 13, 1986

Secretary Elizabeth Dole and I want to thank you for this opportunity to express the Department's position on efforts to stimulate a vigorous commercial expendable launch vehicle industry. This industry can serve a crucial role in providing the United States and its citizens with reliable access to space. While the government has a role in stimulating its growth to compete with subsidized ELV systems in other countries, our most important task will be to stay out of its way, to unleash the forces of a free market.

Recognizing the contribution ELV technology and its industrial base makes in preserving America's preeminence in space, the President and the Congress laid the groundwork for an independent commercial ELV industry in 1984. Since the initial decision, the Department of Transportation has worked to develop the regulatory framework for commercial space launch operations. This fall we plan to complete our licensing guidelines. We have continued steady research to support safety standards, including the development of third party liability requirements. Now additional steps must be taken to provide a climate in which a US commercial ELV industry can develop and take its place in the international marketplace.

As you know, America's aerospace industry has been manufacturing and launching unmanned rockets for more than 25 years. For most of that time, private companies (under contract to NASA) provided the means for placing hundreds of satellites into orbit. Their operations, however, were scaled back as the government chose to place primary reliance on the shuttle.

Our discussion today is prompted by the recognized need to relieve the shuttle of this burden. The members of this subcommittee are well aware of the profound impacts of last January's Challenger accident. It will be 1988 before the shuttle fleet is operational again. And when the shuttle does begin flying, it will be at a more conservative launch rate. This creates a backlog that will be with us well into the 1990s, and could delay other critical NASA missions such as the space station.

Fortunately, the United States can tap the private sector to augment its crippled launch program with highly reliable unmanned rockets and well established manufacturers and launch teams. Newly built commercial ELVs will enable us to "fly off" the backlog at a much more rapid pace. By the early 1990s, the industry can supply up to 41 launches per year: 10 Deltas, 17 Atlases, and 14 Titans. While demand may not warrant the full production capability, each of the responsible companies feels it can compete successfully selling many fewer launches per year.

Some of the missions scheduled to fly in the next six to ten years require a manned presence or the unique capabilities of the shuttle, but other payloads can be flown on ELVs. The Department of Defense has already taken steps to launch some backlogged national security missions on ELVs. As another part of the Administration's effort to develop a strategy for recovering from the Challenger accident, we are taking a close look at what other payloads could be launched on unmanned rockets. Our efforts will bring about a balanced transition to a mixed fleet of manned and unmanned vehicles, with greater reliance on private sector launch services.

Clearly, the United States must provide reliable access to space for all users, including those requiring manned vehicles.

Progress in space will always depend on the human presence -- whether to perform research, to observe the effects of the space environment on people and materials, or to respond to unanticipated problems and developments.

Only a mixed fleet of both manned and unmanned vehicles will ensure reliable access to space. We must reserve our most limited -- and therefore most valuable -- resource, the shuttle, for those activities that require its special capabilities. Consequently, we must rely to a far greater extent on ELVs for those missions that don't require the presence of man. They will provide the additional capacity to expand our fleet as demand requires.

The elements for commercial success exist, and have led major aerospace firms to conclude that the industry can be profitable. Two factors have inhibited the development of this industry. First, historically the government has dominated the space launch business by assuming all the risk and paying all the bills. Second, the industry has been unable to compete with heavily subsidized U.S. Government systems. Consequently, it is essential for the U.S. Government to send the industry a clear signal that it will no longer insist on a government monopoly.

We believe that an active and profitable commercial space transportation industry can develop in the very near future; on the other hand, any further delay in adjusting U.S. Government policies will leave this business wide open to foreign launch services and leave the U.S. at a dangerous disadvantage while the shuttle program is recovering.

In response to the committee's proposed legislative initiatives, we offer the following:

While the U.S. Government is not in the practice of reneging on contracts, the worst, most unrealistic message the government can send the satellite industry is that shuttle launch capacity will exist to carry all pre-accident payloads for which a commitment of some sort was made. By NASA's estimate, that capability, even assuming a replacement orbiter, does not exist. In light of this situation, the Administration is formulating a final policy for fulfilling its commitments. A few payloads are shuttle unique, but most can be adapted to expendable launch vehicles.

The Committee's 1984 action to encourage the use of national ranges by charging "direct" cost to commercial users was a valuable contribution. It is unclear what is accomplished by substituting the word "additive." Again, a clear, understandable government policy is what the ELV industry needs most.

The government's ability to exploit the opportunities that space provides has been constrained by the Challenger accident. Additional launch capacity will be required as a complement to the shuttle fleet. We agree with Dr. Fletcher's judgment that it would be a mistake to legislate numbers of vehicles required to launch government payloads. We further advocate that, to spur the development of a commercial industry, NASA meet its requirements by relying on commercial launch operators and not seek to develop its own ELV fleet.

We commend the Committee for developing creative approaches to stimulate a private sector launch industry. Secretary Dole looks forward to working closely with this Committee over the next several months to develop this industry as a crucial element in our space program.

I would be happy to answer any questions you might have.

Mr. Nelson. Thank you, Mr. Burnley.

Can you hear?

Mr. Burnley. Very well, yes.

Mr. Nelson. Let me get you to respond to the initiatives that I outlined here in this proposed legislation.

Initiative No. 1, that—let me see if I can fairly summarize your comments here—that you would support the procurement by NASA of launch services for working off the backlog of Government payloads?

Mr. Burnley. Yes, sir, to the extent that those are necessary, and where we have a concern is in mandating that to a precise number in legislation. We think that's an issue that's got to be worked through the usual process in making a determination about what those needs are.

Mr. Nelson. Now, why are you concerned about that if it's Government payloads?

Mr. Burnley. Well, we're concerned, Mr. Chairman, because certainly we think that to the extent that NASA remains in the launch business itself, versus procuring those services, that it's going to make it much tougher for the commercial sector in this country to really get the——

Mr. Nelson. I said acquiring launch services.

Mr. Burnley. Yes, sir. We do not have a quarrel at all with acquiring launch services.

Mr. Nelson. Launch services of Government payloads.

Mr. Burnley. Right. We are not quarreling at all on that point. We think that makes good sense.

Mr. Nelson. Well, your response to me in my question was that you were concerned about the number, et cetera, et cetera.

Mr. Burnley. Yes, sir.

Mr. Nelson. Why are you concerned about the number?

Mr. Burnley. Well, frankly, we don't understand that 15 is an agreed-upon number by NASA or the others who are going to have the responsibility for actually operating those payloads, the Government agencies that own the satellites to be launched. So as a result, all I'm suggesting is, as Dr. Fletcher did before me, is that to legislate a specific number may mean that you end up buying too many or too few.

We're not quarreling at all with the concept of buying the necessary launch services.

Mr. Nelson. All right.

Initiative No. 2, the Commercial Space Launch Act would be amended to provide access to Government launch facilities at additive rather than direct cost.

Mr. Burnley. Yes, sir.

Mr. Nelson. Do you agree or not?

Mr. Burnley. As I said in my prepared testimony, we think what the committee did in the 1984 act, in mandating direct costs, was a good step, and we think that the certainty of that provision, the notion that there could be a commonly agreed upon definition of "direct," is the way to go.

Now, to the extent—and we do know that there are some disagreements about how that ought to be interpreted. To the extent there are disagreements, frankly, we would suggest it might be a better process, from the standpoint of all concerned, to try to resolve those disagreements as quickly as possible, rather than substituting yet another new term, which means the debate may start all over again about what "additive" means as compared to "direct."

Mr. NELSON. Well, we're talking about as question of semantics here, aren't we?

Mr. BURNLEY. We sure are.

Mr. NELSON. All right, fine.

Mr. BURNLEY. And all I'm saying is, I'm not sure changing the word is going to resolve the issue.

Mr. NELSON. All right, initiative No. 3, that you would have the price for a shuttle launch to be not less than the price for a comparable U.S. ELV launch.

Mr. BURNLEY. Mr. Chairman, that provision, in concept, sounds pretty good. Our fear is, however, that in trying to actually implement it, we will run into a very difficult problem. The definition, again—and it's going to be both semantics, but it's also going to be economics—is going to be very tough, trying to determine exactly what that comparable private sector ELV launch would cost. It's going to be a question of looking at the size of the payload, making a determination first, of course, on what services are out there as alternatives, and then trying through some formula—again, trying to sit here and think up how you do it is a very, very tough exercise—making a judgment about what the Government's price ought to be.

We believe that the notion that you, at a minimum, ought to recover the Government's cost, if you're going to be in that business, as has been the guidance in the past, is probably a better way to go, simply because you can at least come to some sort of a conclusion.

Another problem, I think, is if you could ever determine what you think that private sector competitive number is that NASA has to be at or above, you're creating a static definition and you're going to have a dynamic marketplace if the industry gets off the ground in a serious way. It's going to be very tough, we think, to have—once you agree upon a definition of what that number ought to be—to have a number that means very much for very long.

Mr. NELSON. Initiative No. 4, that you discourage NASA from the pursuit of the commercial customers on the shuttle by requiring that all revenues obtained over and above the full cost of providing that launch service would revert to the U.S. Treasury instead of to NASA.

Mr. BURNLEY. I think that's a good concept. I have no quarrel with it. It may be, however, quite some time before it has a real impact. And the reason, as you would recognize, is that the costs are going to be quite high, particularly on shuttle payloads, for quite some time to come—the Government's cost I'm talking about. So the notion of a surplus going to the general fund is a good one, but I suspect it would be quite a few years before there would be any such surplus that you could divert.

Mr. NELSON. Initiative No. 5, a statement that would provide that private—the private insurance industry would be encouraged to establish an Underwriters Laboratory.

Mr. BURNLEY. We're in agreement that if the industry—and I'm talking both about the launch operators and satellite segment of the industry—wished to move in that direction, that could make sense, and the Government, through a statement encouraging that movement would certainly be a step forward.

However, I think we would probably also all agree that the best guarantor, if this industry is going to be successful in the long term, of quality and reliability, is going to be the fact that in a competitive marketplace, regardless of price, if your launch vehicles are not up to snuff and you are not achieving a substantial success rate in launches, your business is going to go elsewhere. So that when it comes to the question of the quality control part of an underwriter's kind of operation, we think that the marketplace is very likely to provide the best guarantee of that quality.

This approach, however, is certainly a commendable one if the industry evolves in that direction, and certainly we would see it perfectly appropriate to suggest that that makes sense. On the other hand, I hope it wouldn't result in the Government getting over into the business of helping to set the standards.

Mr. NELSON. Are you the source of the attempts at enacting a policy, as discussed in the working group or in the Economic Policy Council, of prohibiting commercial satellites from flying on the shuttle?

Mr. BURNLEY. I want to plead innocent, Mr. Chairman, and I'm delighted that you asked the question. The answer is an emphatic "No." I don't think——

Mr. NELSON. Who is?

Mr. BURNLEY. I'm not going to say. [Laughter.]

Mr. NELSON. Is it a source within the Department of Transportation?

Mr. BURNLEY. It better not be. I don't think it is.

However, in all seriousness——

Mr. NELSON. Has the Department of Transportation supported that position in the discussions in the working group or the Economic Policy Council?

Mr. BURNLEY. Can I answer the first question? Then I'd be happy to answer the last——

Mr. NELSON. As long as you answer the last question.

Mr. BURNLEY. I would be happy to. I'll do them one at a time.

Mr. Chairman, it has been our view from the beginning, in looking at this issue—and it's a view that we have repeatedly expressed in meetings of all sorts, public and private—that there are going to be some commercial payloads that, because they're shuttle-unique, for example, the shuttle will need to be available for in the long term. It is also emphatically our view, as I have said in my prepared statement, that other business ought to be made available, once and for all, to the private sector and the U.S. Government, to the extent feasible, should get out of it.

But I think that, at least in the discussions I've been privy to, there haven't--I haven't heard any agency suggest that there should be an absolute flat prohibition, with no exceptions whatsoever, to a commercial payload ever going or foreign payload ever going on the shuttle again. That is, frankly, a simple-minded approach to a very complicated issue, and I don't know of anybody in the executive branch that suggested it.

I think that, as you characterized it earlier, the notion that there have been some rumors floating around of that sort is correct. But the rumors, so far as we are aware, and certainly so far as the Transportation Department's policies in this area, are unfounded. And therefore, in answer to question No. 2, no, we haven't supported that simple-minded notion.

Mr. NELSON. Do you know who has?

Mr. BURNLEY. No. Again, as I'm saying to you, in the executive branch, I don't know of any department or agency involved in these policy discussions that has been of the view that there ought to be an absolute, flat, no exceptions, bar. And I think that it really would be impossible to justify such a policy.

But again, I don't want to mislead you in any way. We do believe that the exceptions ought to be exceptions, and exceptions ought not to govern the rule.

Mr. NELSON. Are the press reports accurate, that the President was presented those alternatives and he rejected the flat prohibition of satellites on the shuttle?

Mr. BURNLEY. Mr. Chairman, with all due respect, I think it best that I not sit here and either talk about what I was involved in, or heard secondhand, that was or was not presented to the President by his senior advisers. I would say to you once more, however, I don't know of anybody in the executive branch that has seriously proposed a no exceptions, flat prohibition on commercial payloads for all time on the shuttle.

Mr. NELSON. Do you believe that the Department of Transportation role—well, let me ask it this way. What do you believe to be the DOT role in commercialization of space?

Mr. BURNLEY. Precisely the role, Mr. Chairman, defined by the Congress in the 1984 act, and defined also by the President in his Executive order shortly before that act was signed by the President. And let me elaborate, if I may.

We are charged with two missions, as we understand it. One, we are to help consolidate and try to make as efficient as possible the Government clearance process should a private sector launch operator wish to make a launch from the United States or its territories. We have spent, since the office was first set up and we were given this reponsibility, a great deal of time, energy, and, frankly, very few dollars, given the mission, trying to prepare the groundwork necessary to cut through that redtape. As you know, the U.S. Government was not conceived as an efficient, well-run device for clearing commercial launches. A recent problem it's had to face, is how to do that. So, as a result, we have seen that as one of our two primary missions.

The other mission, as we have understood it, is to do what we could to encourage the growth of such an industry. We have certainly thought that that included, among other things, making sure that when policy options are being discussed, both by the Congress and the executive branch, that all of the ramifications of the various policy options are laid out in terms of how they're going to impact on such an industry.

Mr. NELSON. Mr. Barton, then Mr. Volkmer.

Mr. **Barton**. Thank you, Mr. Chairman.

Mr. **Nelson**. Then Mr. Chapman.

Mr. **Barton**. I want to ask you the same question I asked Dr. Fletcher, about the Office of Space Commercialization, your department's relationship with NASA. Could you give me your impression of just how you all work together and what you think that relationship is?

Mr. **Burnley**. Yes, I would be happy to.

Our relationship, on the whole, has been, I suspect, far healthier than some may believe. It operates both on a technical level—NASA, because it has been the only player in this industry for most of its history, is obviously also the source of most of the technical expertise, NASA and the Defense Department, inside the executive branch. We make no bones about that and we have drawn as much as we can at the technical level on NASA's people for advice and looking, for example, at what kinds of guidelines, if any, we should propose on the safety aspects of a totally private sector launch. We don't claim to have a wealth of expertise and knowledge in that area and we do go to NASA for help on those kinds of issues.

Now, the other areas in which we relate to NASA—and I think quite well, and constructively—is at the senior policymaking level. The Secretary and I both have had any number of discussions with the leadership, present and past, of NASA over the last 2 or 3 years. As Dr. Fletcher said, we do sit on the same working groups, of the Economic Policy Council and SIG [space], and it is clearly the case that NASA's primary mission is broader than simply encouraging a commercial ELV sector. So sometimes they're going to have a little different perspective. We have a much narrower perspective, that you and the President have asked us to take, in encouraging this industry. And, obviously, there are going to be policy issues where we're going to have different views.

That's the way we think it's supposed to work. The fellow in charge, with the Congress' very vigorous guidance, advice and legislation, ultimately decides the policy. And as a result, I think we on the whole have been satisfied with that working relationship.

Let me say in particular, that Dr. Fletcher and Dr. Graham have been very good to work with. We've had any number of discussions with them, and it's not at all limited to just the formal big group conference table kind of setting.

Mr. **Barton**. Let me focus in on—You said you've got a much narrower focus. Chairman Nelson basically went through the commercial space launch policy guidelines that this committee is looking at. I did part of that also with Dr. Fletcher. Dr. Fletcher basically, from the NASA perspective, signed off; he said they didn't have any real problems. If I heard you correctly, you didn't give as unqualified approval. In fact, you seemed a little bit negative on some of them and didn't really, in your written testimony, come forward with any positive alternatives.

In hearings that we had last year before this committee, Director Johnson was actually pushing the committee, if I remember correctly, to move toward just some of these policy changes, and if I heard you, you're backing away a little bit.

Mr. **Burnley**. No, sir. I appreciate you asking that so I can be very clear about that.

Congressman, we think it is a step in the right direction. The last paragraph of my prepared statement, "We commend the committee"—that's meant most sincerely. The committee asked us in the letter of invitation to offer comments, advice, what have you, and that's what I've tried to do.

Now, let's be very very explicit and specific. Dr. Fletcher, if I understood his testimony correctly—and I was here throughout that testimony—said on the very first item that he had the same view that we do about specifying a number, as to the number of launches. So I don't think there's any disagreement there.

Our quibble—and it is that, a quibble—on No. 2 is not directed at all at the notion that there shouldn't be some guidance in this area. Just the contrary. The committee and the Congress gave that guidance in the 1984 act. All I'm suggesting is to query whether substituting yet another word, "additive" for "direct," is going to get us where we all want to go. That is a quibble. That is not by any means a profound criticism and I don't mean for it to be taken as such.

Mr. **Barton**. What's your suggested improvement there, or suggested alternative?

Mr. **Burnley**. Well, I'll tell you, Congressman, as I said in answering the chairman's question, I believe there may yet be some discussions among those who may disagree, in the executive branch and on the Hill, on how "direct" ought to be defined, that could be pushed along perhaps to a successful conclusion. My fear—and that's again why I say it's a quibble; it's not any sort of profound criticism at all—is that we put a new term in the act and we simply start the debate over. I don't suggest that discussing direct guarantees that we'll have a successful conclusion, but I'm not sure that we've finished those discussions.

On the third point, on pricing, again, we certainly don't have any quarrel at all with the notion that—and I think this is precisely where the committee is going—that there ought to be a withdrawal of the subsidy that has previously existed for commercial payloads on the shuttle. And again, I'm quibbling. I'm not criticizing in any basic way.

The alternative, I think, is to look at whether there is a simpler mechanism. My fear here is that mechanically, in implementation, it's going to be very, very tough to come up with a satisfactory definition there.

Mr. **Barton**. We don't go into mechanics, but I think No. 3 is really the heart of the whole issue. If we require that NASA not underbid or cut the private commercial launch industry, I think the bid process, especially if we've got two competitive bidders in the private sector, will handle that without any major problems. The only problem I can see there is if there's some kind of collusion between the private sector and they came in with an inflated bid.

Mr. **Burnley**. If I—I may have perhaps misunderstood the intent here, and let me be sure I understand it. If you're simply saying that NASA would be free to bid on all commercial and foreign payloads, but they could not bid below the private sector, that on the one hand that would be far simpler; that would work mechanically, as compared with trying to come up with a formula.

On the other hand, we would then have profound policy concerns, because our hope is that NASA and the shuttle are going to be focusing in the years to come on the unique and very important missions that the shuttle can carry out, and that the much more routine launches will be made available to the extent possible to the private sector.

So I want to both say yes, that if that's what this means in the committee's view, that's easier. But, on the other hand, I suspect it would probably not get you where the committee says it wishes to go, which is opening up those opportunities to the private sector if NASA is going to be completely free to bid on every payload. don't think NASA is seeking that at this point. I certainly don't understand Dr. Fletcher to be saying that.

Mr. Barton. I don't know that we would want—and this is just a personal opinion, not a committee opinion—that we would want to prohibit NASA from bidding. You know, the private sector, if it gets to be a monopoly, can raise prices——

Mr. Burnley. That's right.

Mr. Barton [continuing]. Just as well as——

Mr. Burnley. Yes, sir.

Mr. Barton [continuing]. The public sector.

Mr. Burnley. Of course. Our concern really has, to date, been spun the other way. We've got all those foreign government subsidized competitors to worry about, and our concern may not ever be really in the foreseeable future that a private monopolist can raise prices beyond all reason.

Mr. Barton. Well, I would—I don't have any further questions. I would suggest that if you have some specific alternatives, then I'm sure the committee would be more than happy to have you bring them forward to us.

Mr. Burnley. Yes, sir.

Mr. Barton. Because I have a feeling this—and I may be speaking out of turn, Mr. Chairman—but this may be on a fast track and we need to move forward with it.

That's all the questions.

Mr. Nelson. Mr. Volkmer.

Mr. Volkmer. Thank you, Mr. Chairman.

Listening to your testimony, it appears that we're on the edge right now of starting a private industry, commercial ELV industry; is that right?

Mr. Burnley. I would think, Congressman, that if we're not right on the edge, we're over the edge. The companies that wish to get into that business will speak for themselves. But they're poised to go. Yes, sir.

Mr. Volkmer. You say in your testimony, by early 1990's, the industry can supply up to 41 launches per year, 10 Deltas, 17 Atlases, and 14 Titans.

Mr. Burnley. Yes, sir. That's what the three companies involved have indicated, as we understand it.

Mr. Volkmer. In 2 years.

Mr. Burnley. Yes, sir.

Mr. VOLKMER. That's McDonnell Douglas, General Dynamics, and Martin Marietta?

Mr. BURNLEY. We're talking, Congressman, in those numbers about the production capacity of the companies. I mean, if the business were there, what could they expand to in the next 2 or 3 years in terms of production rates.

Mr. VOLKMER. That's a little different than saying that they're ready to go and start building and by 1990 they will have these built.

Mr. BURNLEY. Well, I have seen——

Mr. VOLKMER [continuing]. On an annualized basis.

Mr. BURNLEY. I don't think so, sir, with all due respect. They're like any other vendor of either merchandise or services. It's nice to know you have a buyer, at least some potential buyers, out there before you start building. What we're saying is that we understand—and they're going to testify in front of you themselves; you can certainly get much better answers from them than you can from me. But we do clearly understand that they have the ability in the next couple of years to expand to that production rate, and that if the business is there, they're prepared to do so.

Mr. VOLKMER. All right.

I quite agree with the statement that I'm sure they're not going to build them and let them sit around. They're going to build them for people that are already contracted with for utilization.

Mr. BURNLEY. Yes, sir. And they're going to certainly build them much more quickly if they've got a very clear and hopefully permanent signal from the U.S. Government about what its role is going to be in this business in the future.

Mr. VOLKMER. I understand from the testimony of Dr. Fletcher that we may have something out of the Economic Policy Council within a couple of weeks. Do you have any idea if that's accurate or——

Mr. BURNLEY. Congressman, I don't know what the precise date is by which there will be a report back. But I do know that the exercise is supposed to be done in as short a time as reasonably possible and that NASA is supplying virtually all the information necessary. They're the keepers of the manifest. So the discussions, as we are privy to them, are simply looking at the data that NASA makes available and asking questions, and then sending it back up the chain of command.

Mr. VOLKMER. We haven't had one firm make application for a license to launch, have we?

Mr. BURNLEY. No, sir. And, you know, we think that's pretty compelling evidence that the policies to date of the U.S. Government have, frankly, impeded the development of the industry. We think, had the U.S. Government's policies been clearer, that if there had been very concrete signals that we were backing out of the way for these folks, we would have had some license applications.

Mr. VOLKMER. On page 2 of your statement—I just want to clarify something.

Mr. BURNLEY. Yes, sir.

Mr. VOLKMER. I know what it means, but I just want to make sure.

You say "Our efforts will bring about a balanced transition to a mixed fleet of manned and unmanned vehicles" and then the words "with greater reliance on private sector launch services."

Mr. **Burnley**. Yes, sir.

Mr. **Volkmer**. Now, are we talking about there launch services or vehicles?

Mr. **Burnley**. Well, we're talking about vendors who will supply both. The launch services, obviously, in the case of the larger vehicles for the foreseeable future, are going to be from Government-owned facilities that the private companies have to have a leasing arrangement on with NASA or the Defense Department.

Mr. **Volkmer**. That's where we basically get into the question of direct costs and utilization of Government facilities.

Mr. **Burnley**. Yes, sir, that's right.

Mr. **Volkmer**. You're not envisioning, are you, at this time that we're going to have actually private launch pads?

Mr. **Burnley**. Well, there has been some discussion of that by one of the newer companies in this business. But, Congressman, I do not expect in the near future that we're going to have a lot of folks stepping forward, particularly when you've got these existing facilities where the capacity is quite ample today. Titans, for example, have two pads on each coast. It's highly unlikely you would see a lot of folks stepping forward overnight to set up their own launch pads.

However, it certainly is conceivable, and I think ultimately will be the case, that there will be, particularly on some of the smaller launch vehicles, some separate pad operations.

Mr. **Volkmer**. All right. Let's assume something for the minute, that—for the purpose of discussion—that in a few weeks it is announced that NASA is basically going to go with—that they will launch only payloads from the shuttle that are necessary either for defense purposes or for their own because of the vehicle type, et cetera, and that commercial payloads will have to find their own way. Let's assume that as a scenario.

Do you evision then that some of these private marketers will start contacting some of these commercial people to see if they wish to have their launch vehicle——

Mr. **Burnley**. Congressman, it is our understanding that those contacts began several months ago.

Mr. **Volkmer**. Those have already been done?

Mr. **Burnley**. Yes, sir. Contracts have not been signed, but discussions, we understand, have occurred and are occurring, and I'm sure again when you have the witnesses from those companies they may be able to tell you a good deal more about the specifics to the extent they feel free to. Obviously, when they haven't signed the contract yet, there's a lot they probably don't want to say in public.

Mr. **Volkmer**. Right; I agree with that.

But the part that's in there—I'll get back to your launch services, because before they contract for that vehicle they're going to want to know what those launch services are going to cost them, are they not?

Mr. **Burnley**. Yes, sir.

Mr. **Volkmer**. And we don't know that yet, do we?

Mr. **Burnley**. No, and we share the view that was expressed earlier, that the sooner that's laid to rest, the better. We have certainly been encouraging the owners and operators of the Government launch pads, DOD and NASA, to move along in that direction. Ultimately it's their call, not ours, and that again is part of what we understand our responsibility to be, is to try to expedite such discussions.

Mr. **Volkmer**. Isn't it your responsibility basically under the 1984 act not only to expedite it but to, in other words, be able to advise the commercial sector, the private sector, what it will cost?

Mr. **Burnley**. Yes, sir, to the extent that such advice can be given; however, it's got to be based on agreements, and that's the area in which obviously the ultimate decisionmaking authority is in DOD and in NASA. I mean, we can promote, expedite, advise, but we don't have the final call on that.

Mr. **Volkmer**. I agree with that. But where is the problem?

Mr. **Burnley**. Congressman, I don't know that there is what I would characterize as a problem. Clearly, however, there are some unanswered questions, and those who control the launch pads need to, as soon as they can, in our judgment, answer those questions. I think—I hesitate to be more specific than that because, again, we're not trying to take cheap shots or be at all critical of them, but we have tried in our discussions with them to move them in that direction to the extent we can assist.

Mr. **Volkmer**. Well, my problem is one who had some interest in the development of that legislation, and the industry as a possibility for the future, you may not want to get into specifics, but I don't see how else we can do it if we're not going to have answers.

Mr. **Burnley**. You're right. There have to be agreements. And again, I share your view, that the sooner the better, and it's going to be very tough for General Dynamics, Martin Marietta, Transpace, whoever, to sign a contract with that open-ended——

Mr. **Volkmer**. All right. Thank you very much, Mr. Chairman.

Mr. **Nelson**. Okay. Mr. Chapman.

Mr. **Chapman**. You say in your testimony, talking in terms of the existing contracts or developing a final policy of dealing with our commitment to those that thought we would be able to handle the launch of their satellites.

Can you give me some idea of what you expect that policy to be? How are we going—I heard Dr. Fletcher say, for example, that we don't need to send a signal that the United States of America breaches its contracts. Yet, in your testimony you say we've got to do something because we don't have—and so does he—the capability to perform.

What is that policy going to be?

Mr. **Burnley**. Congressman, I will not presume to sit here and predict what the President's final decision on that will be. I will, however, simply observe, expanding a little bit on the testimony, that while we do not want to see the U.S. Government abrogating its contracts as a routine matter, we have had a cataclysm. And clearly, as Dr. Fletcher testified earlier this afternoon, the shuttle will not be able to carry this very large backlog for some years to come, and it will have to be handled by some other arrangements.

So our strong view has been in these discussions in the last several months that, to the extent possible, those arrangements ought to make room for the private sector, so that the folks who have got the ability to move quickly to build the launch vehicles can do so and can sign contracts.

I do think that there is not nearly as much of a difference here as might appear at first blush and that we certain agree with NASA that abrogating contracts is a very unattractive alternative. But we've got what in the private sector is often treated under an "act of God" clause. In the private sector, when two private parties contract and you have something of that sort occur, there's a release for both parties from the contract. We don't think this is substantially different from that kind of a situation. We do think, on the other hand, that fortunately our private sector has the potential to move very quickly in this area, to help fly that backlog off.

Mr. CHAPMAN. Surely it would not be the administration's position that the space shuttle tragedy was an "act of God," so——

Mr. BURNLEY. No, sir, I'm sure not.

Mr. CHAPMAN. How do you—You haven't answered my question. I'm trying to figure out, one, what that policy is likely to be, and how much is it going to cost.

Mr. BURNLEY. Well, sir, you're right. I haven't answered your question. I'm here as Deputy Secretary of Transportation. The President will ultimately answer that question, and so I can't.

But I do think there are going to be costs associated, obviously, with making alternative arrangements. But the costs are not all monetary, and we should recognize that for many of the satellite owners who were counting on the shuttle being available through the late eighties and early nineties, four orbiters, 24 launches a year, that the largest cost for many of them may be delay and that they may well wish to make additional expenditures if they can get their satellites up sooner. We just want to be sure that, to the extent the private sector can pick up that load, it's given a clean shot at doing so.

Mr. CHAPMAN. Are you in a position to know at this time whether or not—whatever approach the administration might take in dealing with that problem, it would seem it might be an appropriate time in hearings on this particular legislation, will that approach require legislation, in your opinion, and would it not be an appropriate time, considering what we're doing here, to address that issue and perhaps include it?

Mr. BURNLEY. Yes, sir.

Congressman, as is true with almost any legal issue, particularly an unprecedented legal issue of this sort, because you're right—I mean, this is not an act of God, and I wasn't suggesting that it was; I was using that as an analogy—nonetheless, as many lawyers as look at it will probably find different nuances and shadings about whether under the existing contracts legislation is necessary.

It is our understanding that the prevailing view among the laywers that have looked at this—and it's the Justice Department's view—was that NASA had sufficient authority under the existing statutes and contracts to be able to step away, should that be the policy call. But certainly, I'm sure the administration would not hesitate to come to you for additional legislation should it be necessary. To date, as I understand the dominant legal view, that has not been necessary.

Mr. **Volkmer**. Will the gentleman yield——

Mr. **Chapman**. Surely, I yield to the gentleman.

Mr. **Volkmer** [continuing]. For another matter?

I would just like to express my view on something, Mr. Burnley, and using the word "direct". There has been a record made on that when we enacted the 1984 act, and until I hear from proponents who wish to change that to "additive", I'm in general agreement with you—unless I can be persuaded different—that I'm afraid it may just muddy up the water more rather than correct it.

I just wanted that for the record.

Mr. **Chapman**. I believe that's all, Mr. Chairman.

Mr. **Nelson**. Mr. Barton.

Mr. **Barton**. I just had one final question, not on this particular ELV issue. But in this budget year our committee has had a real battle with the Department of Transportation on the Office of Commercial Space Transportation requesting their budget through this committee. We finally had to go to the Appropriations Committee and appropriate through that. It's my understanding that Secretary Dole has agreed to submit the budget request to this committee for this year; is that your understanding?

Mr. **Burnley**. For fiscal year 1988, Congressman, I believe. Yes, that is very clearly my understanding.

Mr. **Barton**. So we've got that battle behind us.

Mr. **Burnley**. You have our attention.

Mr. **Barton**. OK. Thank you.

Mr. **Burnley**. I would just note for the record, however, that if we're not around, if we are zeroed out in the 1987 appropriations, it's going to be very difficult for us to come back to you for 1988. So I hope we'll have sufficent funds and personnel to be able to do that. But we do think that that was a most unfortunate misunderstanding and it's been fixed.

Mr. **Barton**. OK. No more questions.

Mr. **Chapman**. Mr. Chairman, let me, if I may——

Mr. **Nelson**. Yes, Mr. Chapman.

Mr. **Chapman**. Let me ask one additional question based on what you said.

Is it the—The other side of the contracts that NASA has, are they generally aware of the position of the Justice Department attorneys, that they think NASA can step back from those, if that were the——

Mr. **Burnley**. Congressman, I frankly think you would have to ask them. My understanding is that that has not been kept terribly secret, and they've got lawyers who can read and probably predict what the Government attorneys may or may not say by way of interpretation. But I think——

Mr. **Chapman**. And sue somebody if they don't like it.

Mr. **Burnley**. That's right. However, you've got to have a basis for filing a lawsuit first. Second, I do think that the extent to which the U.S. Government, in managing its way out of this crisis, provides a satisfactory, smooth alternative—and we think to the extent you get out of the way of the private sector so they can step in, that that's certainly the most likely to give you this result—

that there will be a whole lot less incentive for litigation and controversy. Because what ultimately the satellite owners want to do is get their birds up, and to the extent we can move in that direction, quickly and efficiently—and again, we think the private sector is ready to move—and you'll hear from them—we think that controversy can be greatly reduced or eliminated.

Mr. CHAPMAN. Of course, that was precisely my point, that I think what NASA perhaps needs least is to be embroiled in litigation over those contract——

Mr. BURNLEY. No question. Yes, sir, I agree with that.

Mr. CHAPMAN. Thank you, Mr. Chairman.

Mr. NELSON. Thank you, Mr. Chapman.

Let me state to you a proposed policy and you tell me whether or not you agree with it. That commercial satellites would be encouraged to fly on commercial ELV's, but that manufacturers of satellites would also be encouraged to make them dual compatible in the event that some catastrophe struck the ELV's, so that they would be capable then of flying on the shuttle as a backup.

Do you agree or disagree?

Mr. BURNLEY. Congressman, as an official of the U.S. Government, reluctantly I say I disagree, personally. If I were the owner of the satellite, and if the cost of being able to fly either way easily and quickly was reasonable, I would emphatically agree. It would be good business sense to agree.

The only disagreement I have with that proposal is that I'm not sure we ought to dictate it. But you didn't dictate it. You said encourage. I am not, therefore, certain what the word "encourage" means in that context. If encourage means there are going to be governmental policies, whether legislative or regulatory, that, in effect, require that approach, then I've got some real hesitation about it. If encourage simply means to exhort and literally encourage, but not to, in effect, mandate, then certainly it makes good sense and my concerns would be allayed.

Mr. NELSON. What "encourage" means is that you don't have a policy that prohibits them from flying on the shuttle. Therefore, they have an incentive or security for backup reasons of making them dual compatible. That's what encourage means.

Mr. BURNLEY. Well, we have not—again, Congressman, as I said at the outset of my testimony—suggested a flat prohibition. I do think——

Mr. NELSON. Well, it sounds to me that you are——

Mr. BURNLEY. No, sir.

Mr. NELSON [continuing]. By virtue of the example I just gave you, of which you said you disagreed with it.

Mr. BURNLEY. No, sir. Let me clarify.

Mr. NELSON. Please.

Mr. BURNLEY. There is no question, on the other hand, that—in the real world that we've all got to come to grips with here—that there's a huge backlog to go on the shuttle for years to come, even with a fourth orbiter. It may well be the case that, even if you have that ability to quickly move the satellite to the shuttle from an ELV, that the payload capacity will still make that impossible given the other priorities that NASA must—and as you have outlined in your legislative proposal, which I did get a brief glimpse at, that you unveiled this morning. It just may not be feasible.

Now, it does seem to us, under those circumstances, that we ought to do all we can, as you have said, to encourage the development of the commercial ELV sector. It does also seem to us, however, that one of these days that commercial ELV sector is going to be able to fully meet the commercial payload needs, and the shuttle is—and I, with great hesitation say this to you, given your experience, personal experiences—a shuttle is an extraordinary and unique and very, very special device. It ought to be used for extraordinary, unique and special missions. And to the extent that the commercial side of the business has become routine, we don't think the shuttle ought to be in the pickup truck business if there are other reasonable alternatives. We think the private sector can provide those reasonable alternatives.

So again, I think the shuttle, when the day comes the shuttle has that capacity, and insuring against the risk that the particular ELV system you built your satellite for might have its own problems and you would have a lot of downtime and delay that you hadn't anticipated when you signed your contract, could the shuttle conceivably be available as a backup in that situation. I'm not here to quibble with that as an idea.

I don't think, though, in the next 5 to 10 years it's likely to be the case, that the shuttle would be available in that situation, unless you had bumped some other fairly important payloads. And even then, I would think we would want to have some further discussion as a government about what it was we wanted to have people go up with and what payloads should be on a manned vehicle versus being sent to the unmanned side.

That, again though, is not to preclude NASA from flying some commercial and some foreign payloads. I mean, there are some where the private sector and foreign government ELV's are simply not able to do the launch. And in those cases, NASA is probably going to have to use the shuttle.

Mr. **Nelson**. Either your departmental policy or your personal policy has not crystalized so that it is crystal clear in your own mind, and certainly in the minds of others to whom you would try to articulate it, or either you and I just have a basic disagreement.

If it is the latter, let me respectfully suggest to you that one of the lessons that we learned out of the January 28th accident is the fact that we need to have more available horses in the stable in order to have assured access to space. That's why we're pursuing this new policy.

Now, part of that new policy recognizes that if for one reason and another you lose one of those vehicles, you want to have the capability of having a backup. And since here in the commercial satellite world, which means big bucks to an American ELV enterprise, and it means an awful lot to the manufacturers of the satellites and the owners of the satellites to know that they have that capability of getting up if one of the systems is down, that they have that assurance of knowing that there is a backup, that is simply why it seems to me, and I think clearly to a majority—if not unanimously—from this committee, that you want to adopt a policy that encourages the dual capability so that you have it and we don't get in the situation that we find ourselves in right now.

Mr. **Burnley**. Congressman, I don't know whether we disagree or not. But I do think that it's pretty plain what our position is, and I will restate it, and perhaps state it slightly differently to clarify it.

If the owner of a communications satellite is going to use it for routine telephone transmissions and the private sector wishes to make that satellite compatible with two launch systems, we believe that makes good sense from a business standpoint. We do not believe the U.S. Government should dictate or mandate that, and to the extent it encourages it through exhortation, that's fine. To the extent its policies, in effect, indirectly or directly coerce, we do have a disagreement.

We do think, however, that NASA, using the STS, can provide a very valuable service as to some limited numbers of exceptions where you've got a shuttle-unique commercial payload. But we don't think in the years to come the shuttle ought to be a pickup truck. Where you've got a standardized, ordinary, in this day and age, communications satellite being used for telecommunications purposes in the private sector, we query whether it should be the policy of the U.S. Government that NASA use the shuttle as a backup if the particular launch vehicle with whom that satellite owner has signed a contract can't provide the service.

Frankly, I don't think, when all is said and done, that's the direction that the committee is going in. But if I misunderstand and that is the direction the committee is going in, then yes, I think you would correctly conclude there is disagreement about that. But I don't think, on the other hand, let me hasten to add, this is an either/or kind of question. There are a lot of cases that don't fit precisely into the box that I've just described. As to the ordinary telecommunications satellites, we've got a pretty clear and pronounced view. As to satellites that are shuttle-unique by definition, of course, there should be an opportunity for those to go up. But that doesn't give you the kind of backup you're talking about, either. That means, in effect, there's only one launch vehicle for those satellites.

Mr. **Nelson**. We've had all the satellite manufacturers and satellite users in here. They have basically told us that they prefer ELV's to launch on, but they want that shuttle as a backup for security, of knowing they can get to space when they need to get to space.

Mr. **Burnley**. I'm sure that's true. Again, as I say, a prudent businessman would come to that conclusion. I don't doubt for a moment that's their view, and that's what they've told us as well.

Mr. **Nelson**. All right, let me ask you this.

The proposal that we're considering here legislatively is certainly going to enhance this ELV activity. If the ELV activity is robust and it's commercially oriented, et cetera, do you believe that there would be the need for a special advocacy office in the Department of Transportation for commercial ELV activity?

Mr. **Burnley**. The answer to that is, once it's up and robust and on its way, and the Government's policies, once and for all, are clearly delineated, once that day has come—and some of us have sometimes despaired that that day would come; but we now are optimistic again that it will come soon—that the advocacy role of that office will be substantially less significant and important.

We need to be on guard against creeping Government policies that inhibit that industry yet again. But there's another, as I said earlier in my testimony, very, very important part of the office's responsibilities, and the day that you've got that robust industry, those responsibilities are going to be far more important than they are today. And that's going to be making sure that the minimum safety requirements that the U.S. Government ought to make sure for the sake of its citizenry are met through the licensing process—taking care of safety concerns and national security concerns, technology transfer concerns, what have you—that the licensing process does not become, as it has been in the past, an inhibition to the industry.

So I think you're exactly right. The advocacy, promotional side of the responsibilities will be diminished, but you'll see a corresponding increase by definition in the responsibilities of making sure that the U.S. Government both looks after the safety side of this issue and moves as efficiently as possible through the licensing process with the particular launch vendor.

Mr. NELSON. Do you think there might be a conflict between housing both the regulatory and promotional responsibility within the same agency?

Mr. BURNLEY. Congressman, that is an excellent question and it's a question that we at DOT wrestle with in some other areas. And the answer is that it can be a conflict but it does not have to be. Certainly, when the industry is mature and robust, as you described it, the risk will be greater. I think for the foreseeable future, however, that there is no substantial risk in that regard. We are still in what we hope are the final stages of the policy discussion about how the Government will relate to this industry, and that when that discussion is concluded, certainly our overwhelming focus is going to be on the licensing side and making sure that the licensing process moves smoothly.

Mr. NELSON. Do any of the members have any additional questions?

Well, we thank you, Mr. Burnley.

Mr. BURNLEY. Thank you very much for the chance to be here.

Mr. NELSON. We appreciate you being with us.

Mr. Iorillo, let me ask you now, you've got a time problem, don't you?

Mr. IORILLO. Yes, I do.

Mr. NELSON. What's your time problem?

Mr. IORILLO. I would like to leave by about quarter to 5, if I could.

Mr. NELSON. All right. There is a vote in progress. I will run over and vote, come right back, and we'll proceed with you and we'll see if we can get you out of here by quarter of 5.

Mr. IORILLO. Thank you very much for your indulgence.

Mr. NELSON. The committee will be in recess.

[Whereupon, the subcommittee was in recess.]

Mr. NELSON. Mr. Iorillo, you're going to have to talk fast.

Mr. IORILLO. As a matter of fact, Congressman, I've done the prudent thing and I've already ordered a backup. I have made arrangements to leave about an hour later. So I can answer some questions. Otherwise, I'd never make it.

Mr. NELSON. Well, I apologize for all the interruptions, but we are unable to do anything other.

So if you will proceed, I appreciate it.

STATEMENT OF ANTHONY J. IORILLO, VICE PRESIDENT AND GROUP PRESIDENT, SPACE AND COMMUNICATIONS GROUP, HUGHES AIRCRAFT CO.

Mr. IORILLO. Thank you, Mr. Chairman.

First of all, I would like to thank you very much for inviting us here to comment on your initiative. I'd like to tell you that we appreciate your initiative. It's a breath of fresh air in this whole matter because we, as you, have been very concerned that the precipitous policy changes advocated—albeit no one can tell who's advocating it—advocated by members of the administration will be harmful to our industry. We, like you, believe that the shuttle should remain an alternative source for commercial satellite launches until such time as a competitive, viable, domestic expendable launch vehicle capability is actually in place. And, without that, we fear that the $2 billion a year commercial satellite industry, which we, supported by you, have created over these past several decades, will really be in jeopardy.

Mr. NELSON. All right, now. Let me make sure I understood what you just said.

You said that the policies articulated by Mr. Burnley, that you view that as being contrary to your interest?

Mr. IORILLO. I was having a little difficulty in understanding exactly what Mr. Burnley was espousing. So to that extent, I can't answer your question directly. But I can state that all the policies that we heard were that the Federal Government backs out of the launch vehicle industry, which it has maintained for the past two decades, without having an adequate, viable commercial ELV industry in place.

And what do I mean by in place? I mean a place I can go to and say, "I have a launch requirement; can you quote me a price and a date?" Now, until I can get a price quote and a date fixed for a launch in the near future, as far as I'm concerned, the guy's not in business.

We have that problem right now. We, like many others, are in the process of constructing communications satellites for which we have already sold service. We have, in turn, contracted with people to provide service. We have a contract with them. We have an obligation in good faith to do our very best to provide that service on the time contracted for. We understand right now that the shuttle can't launch us, and that's clear. So we've had to go out—and we've talked to all the manufacturers of ELV's in the country and said, "Look, I need a launch in 1988 and a second one right after it, as close as I can get it to 1988. Can you provide us something?" And we have not yet received a firm price or a quote for that kind of time scale. So we've had no alternative but to go to Arianespace. Even with their troubles, they're at least willing to sign a contract for a price, and the price goes up all the time, but at least for a price. It's more than we contracted for with NASA, so it is starting to take the profit out of that business—and it's not that profitable a business to start off with. So it's giving us problems. But, nonetheless, since we have a contract to provide the service, we feel compelled to take it, even though it is costing us money.

Now, Ariane has had its difficulties, as you well know, and it could very well be that in the next 12 or 13 launches—because I think we're about 12th down the line in the sequence of Ariane launches—that they'll have some more trouble. Meanwhile, we're sitting there with the same contractual obligations. We'd like to feel we have some place to turn to if, in fact, those launches are unsuccessful, because we have invested a lot of money; and our customers have invested a lot of money.

And in the specific case I'm talking about, it's really with the Japanese Government that we've made a deal, because we have an obligation that was really fostered by President Reagan. We are one of the first companies to ever export communications equipment to the Japanese, and we're doing so in the following way:

We have a 30-percent interest in a Japanese company called JC-SAT. The majority interests are owned by C. Itoh and Mitsui, two of the largest Japanese trading firms. That company, in turn, has purchased communication satellites from us and launches. We are responsible for delivering the launches.

Now, they were encouraged to do this—in fact, muscled into doing this—by the President, encouraging the Japanese to buy more American, to encourage a more favorable balance of trade. We, in turn, then held a competition for launches—we were obligated to do so in good faith on their behalf, our partner's behalf—a competition between Ariane and the shuttle. NASA submitted a proposal to us and so did Arianespace. We selected NASA because the terms were much more favorable, and besides, the shuttle just has a better track record. Now, Arianespace was relatively competitive and it was a professional proposal they made to us, but for good technical reasons, we elected to stay with the shuttle.

Now, the situation we find ourselves in now is that NASA can't deliver by force majeure the launches on the dates that they contracted for, so we've had no option but to go back to Ariane and say, "OK, can you provide service?" and they will.

We have not been able to do that same thing with a domestic manufacturer yet. They're not yet in a position to do so. So that's what I mean by I really would like to have the shuttle available to back up that kind of business arrangement.

Mr. Nelson. OK. Given this kind of experience that you've had, what do you think about this proposal? Do you think that it would be the basis upon which a viable commercial ELV industry could spring?

Mr. Iorillo. I think a viable commercial industry can spring, but only if the Government continues to support it in one way or another. Now, what do I mean by that?

First, all the current ELV's have really been subsidized by the Government in terms of their development costs originally. First, as ICBM's, as Dr. Fletcher said this afternoon, and then in terms of their being upgraded for more capability over the years. So in that sense, the development costs of the current fleet of ELV's has really been paid for by the Government.

The problem is, as Jim Fletcher has also said today, and very eloquently, it has been 30 years since a new ELV was designed—and he reminded us that he was part of it—take the Titan, for example. The Titan was developed and designed first to be an ICBM. Its diameter for both the two liquid stages, the core of the Titan stack, was really constrained by the 10-foot diameter. Why was that? Well, that's because it had to fit into an ICBM silo, and more than that, because in order to be transported to the silo fields, it had to be transportable on the bridges. So that's where that rocket started. And over the years, in a series of remodels, as he said, first an Agena was added to it to enable launching satellites to high altitude, later solid rocket stacks were stacked on the side of it to enable launching the larger satellites, and more recently, to make it a viable backup to the shuttle, a Centaur stage was added to it to approximate the capacity of the shuttle in terms of lift. And the bulbous 15-foot-diameter shroud was added at the top to house the volume of the modern satellites, which we designed for the shuttle.

The fact is that in those series of remodels—and they were clever, and it was a very acceptable backup to the shuttle—the problem is right now that it does not represent America's best effort to design an optimum, modern day, world class satellite launcher. It is not like the Ariane V, for example, which is the result of 10 years of struggle on behalf of Arianespace, in competition with the shuttle, knowing what the marketplace is, knowing that they had to get down in price in order to compete with the shuttle. They've taken their best minds and their best technology and they are working on a satellite launcher specifically designed, without constraints of any sort from the past, to lower the cost of launching satellites of the size that we're all building. So it's going to be one tough cookie to beat.

I guess here is the answer to your question—I don't think that without substantial support from the Government, one way or another, the systems that are available now, more Titans, more Atlases, or more Deltas, stretched or added to, really in the long run, on a technical basis, will be competitive with a freshly designed launch system. So that no, without Government help of one form or another we can't have a truly competitive, as I have said in the written text that I've submitted for the record, world class ELV available on which to base our commercial business. So——

Mr. NELSON. Well, then what you're calling for is a consortium of aerospace companies getting together and building a world class, competitive vehicle.

Mr. IORILLO. You got it.

Mr. NELSON. Now, how do you do that?

Mr. IORILLO. OK. First of all, we tried to create a concrete proposal, an example of what might be done and might be done now. We took the opportunity the Air Force gave us in their call for a medium launch vehicle, the MLV contract, to submit the ideas. Now, we've been working on this ever since, very vigorously, ever since the *Challenger* accident. And I guess, as you know, we have named our proposal the Jarvis booster after Greg Jarvis, our colleague who was lost in *Challenger*.

What we tried to do with this consortium—we, Boeing and Rocketdyne—was try to synthesize something, and frankly, it can hardly be called a medium launch vehicle; we prefer to think of it as a modern launch vehicle. We took what we believed to be some of the finest, most cost-effective technology available in the world—and we found it right here in this country—and we talked to everybody in the world, including the People's Republic of China, including the French, including the Japanese, and every other component manufacturer in this country.

We selected from all that was available the Saturn rockets, the F-1 and J-2 liquid rocket engines originally used in the Saturn vehicle, which represented the cheapest thing we could find in terms of dollars per pound of thrust. And all rockets start with pounds of thrust. We combined that with the shuttle liquid propellant tanks, which are being mass produced in Michoud at a fair clip for the shuttle, combined those elements into a two-stage liquid rocket, having only three engines, two in the first stage and one in the second stage, capable of lifting 85,000 pounds into the low-Earth orbit. That's about 50 percent more than shuttle can launch and about twice as much as the Titan IV.

To that we added a third stage, comprising the storable liquid system, that in many respects is very much like the satellite we're currently building for the Department of Defense. And then, since the whole stack has the nominal 28-foot diameter of the shuttle liquid tanks, we just put a 28-foot-diameter shroud on it. As you can imagine then, the volume inside that 28-foot-diameter shroud is approximately four times that of the shuttle bay.

Now, the whole idea here, and the reason we used a satellite-like upper stage, was so that it could carry one, two, three, or four satellites at a time. With the maneuverability and long life it has, we envision that it's very practical to go up to high altitude, drop two off in medium altitude, take two more up to synchronous altitude. And what we tried to do here was to preserve what we still believe is one of the best ideas, the fundamental ideas underlying the shuttle, and that's its ability to carry multiple satellites to orbit, thereby lowering the launch costs per satellite launched. We don't want to lose that specific idea. So we put this idea together.

And then you've heard Dr. Fletcher say that there'll be requirements in the future for heavier lift vehicles. I didn't tell you that this specific Jarvis with the storable liquid propellant will inject about 12,000 pounds into the synchronous orbit, which is more than you can get right now from either the shuttle or the Titan. But that third stage can be replaced quite simply with a Centaur-like cryogenic stage, and that configuration will inject 24,000 pounds into synchronous orbit or almost 2½ times the basic capacity of shuttle or the Titan, leaving plenty of room there for growth in the Defense missions, the NASA missions, and the commercial missions, taking us into the 21st century.

That's what we think can be done. How much will it cost? I think that's the operative question. We think that because we have F-1 and J-2 engines already in NASA stores—and that's the only reason why this whole thing works, by the way—there are enough in NASA stores to start the development program and have enough ready for the first couple operational launches—we have a head start; they need to be refurbished—that we can get this thing done in 4 years, and it will take about a billion dollars to the first launch.

After that, on a per copy basis, since the elements are mass produced, with the finest tooling in the world, at Michoud, and these engines—even NASA projects that they should cost $7 to $10 million a copy, with only three engines in the whole stack, you can envision that it shouldn't be a hell of an expensive stage. We estimate that it will cost $150 million a copy thereafter.

Now, when you take into account the number of satellites you can launch at a time, we project that it promises to halve the cost of satellites relative to either the Ariane V, which is really the enemy, or the Titan IV. And when you think about the $1 billion spread over 3 years, that only represents 2 percent of our annual expenditures in space, if I include what the Government spends for Defense, NASA, and what is invested in the commercial industry. And given the fact that this world class rocket, as we like to call it, will satisfy all the needs, we think that the investment seems to be modest relative to the returns.

Now, as I have said in my paper, we made this proposal for two specific reasons. One, because, like you, we sensed that the country was languishing in this whole area and there was no direction or leadership. So what we tried to do was to make the statement and point out that the country can, in a relatively short time—because it has the basic technology in its stores—have a world class rocket, one that is competitive on fundamental economic grounds, as the shuttle was to have been, and that it can compete with any rocket on Earth, and we'll have it for all our missions, and we don't have to wait 10 years to get it. We could have it in 4 because of what we have in stores.

The second point that we would really like to make here is that if we used this time—and it's a very important time in our history—if we used the time and the money which we have available and buy, because of expediency and pragmatic requirements, more Titans or Atlases or Thors, stretched or not stretched, we aren't going to be any better off in 4 years than we are right now with respect to that world class competition. And what we would like to do with this proposal—and we know it's a challenge to the rocket industry, and I can tell you we meant it to be exactly that—what we really want to do is stimulate bold new responses to get us moving again.

You know, I guess my closing statement in my written text goes something like this—and I'll repeat it to you because I really believe it. Ever since the *Challenger* accident, we, like you, have sensed a growing crystallization of the perception of the American people, a new understanding as to what a launch vehicle is and what its real job is. That's quite simply to get us to space when we have to get there. Right now, we can't get there. Everybody in this country—not just national security planners—all of us, are concerned about the health of our communications, and our weather satellites.

All of us, not just isolated scientists or professors in universities around the world, lament the lost opportunity in our generation to continue exploration of the universe. And I can't wait for that

Hubble telescope to get up there. I'm dying to find out just how big the universe is before my time is over. Now, all of us, and we in this industry, for the first time have felt the growing power of Europe and Japan in our field, and we have seen their intense willingness to compete, their enthusiastic willingness to compete. I guess we sense for the first time the vulnerability of our leadership in space, and for 6 months we have been reeling and have been on the defensive and we don't like it.

What we have tried to do with our Jarvis proposal is to make a suggestion that we think could get this country back on the road again, back on the offensive where it belongs. It's quite that simple. That's the whole reason for our proposing Jarvis.

[The prepared statement of Mr. Iorillo follows:]

Statement of Anthony J. Iorillo
Vice President and Group President
Space and Communciations Group
Hughes Aircraft Company

before the
Subcommittee on Space Science and Applications
Science and Technology Committee
United States House of Representatives
August 13, 1986

Thank you very much for inviting us to comment on the legislative initiative you are considering. We welcome your attention to the issue of Space Launch Policy. As you are well aware, we are very concerned that the precipitous launch policy changes advocated by some members of the administration will be counterproductive for our industry. Specifically, we believe that the Shuttle should remain an alternative for commercial satellite launches until such time as a competitive U.S. expendable launch vehicle (ELV) capability is actually in place. Without that, the existing $2 billion/year American commercial satellite business will be significantly damaged.

At the same time we believe a new ELV capability is necessary and that the nation should create policies to bring it about promptly. We want to underscore that this new ELV capability is needed for the entire U.S. space effort not solely or primarily for commercial satellite launches. We sense a growing realization that we all share the same problem, DoD, NASA, and industry. The Challenger accident unveiled a basic flaw in the STS concept. Manned spaceflight and routine launching of operational satellites to orbit do not mix well. The great promises of the Shuttle to dramatically reduce the cost of launching satellites is not achievable in this manned vehicle.

The recent cancellation of the Shuttle Centaur has catalyzed this new awareness. As a result, the Shuttle can no longer launch many important DoD and NASA payloads. In a few short weeks, the 30-year old Titan ICBM based complementary expendable launch vehicle (CELV) went from a backup vehicle to America's front line launch system. One needs only a casual knowledge of history and rocketry to understand that the Titan IV is not the product of America's best effort to design an optimum satellite launcher. The 10-foot diameter Titan liquid stages were initially designed to fit into ICBM silos and be transported under bridges. Agena upper stages were added to enable satellite launching. Solid rockets were strapped on to launch even larger satellites. More recently, the Centaur stage replaced the Agena to match the Shuttle capacity and the bulbous shroud was designed to house the larger volume of modern satellites. The Titan has been a remarkably reliable work horse and has played a central role in our space programs. It was an acceptable backup for Shuttle. It was certainly not intended to be its successor.

The first order of business for our entire space program is to move out aggressively to make up for sixteen years of ELV neglect. The entire operational space community needs what the commercial satellite segment needs: reliable access to space at the lowest possible cost. The entire community needs a world class ELV system on which to base our future. What do I mean by world class ELV? I mean an ELV that competes with and beats in both reliability and cost the European Ariane IV and Ariane V, the Japanese H-II, and the rockets currently being offered for commercial launches by the People's Republic of China and the Soviets. And we cannot develop a world class ELV by yet one more modification to launch vehicle configurations originally created over 30 years ago. To get back on track will require leadership and a major investment.

If we make the right choices now, we can emerge even stronger than before. This subcommittee can help the country to make the right choices and to take a fresh look at space transportation in general. We need a vigorous national program to develop the world class ELV. Encourage the USAF to move forcefully in the acquisition of low cost launch capability. They have the highest priority need. They clearly have the capacity to lead the way. When they meet the goals of a reliable low cost launch, the NASA science programs and the commercial sector will benefit naturally.

For nearly thirty years the three operational space users have been partners. This has been a natural partnership from which each has benefited. I see no reason that this natural alliance should be dissolved at this point in our history when we all face the same serious crisis. When the USAF develops a source for low cost reliable launches, we all will have one. The policy this committee is pursuing will be a lot easier to implement when this task is accomplished.

To provide a concrete example of what might be done, we, together with BOEING and ROCKETDYNE, have synthesized a practical, affordable step toward the goal I have been talking about. We took the opportunity the USAF offered in their call for a medium launch vehicle (MLV) to insert our ideas for consideration. We have named our new ELV design after Gregory B. Jarvis, our colleague who was lost on Challenger.

As you are aware by now, our JARVIS booster proposal can hardly be called medium. Rather, we prefer to think of it as a modern launch vehicle. We have harnessed what we believe to be the most cost effective and reliable technology anywhere --- SATURN engines and Shuttle liquid propellant tanks. We have combined them into a two stage liquid rocket capable of launching 85,000 pounds into low earth orbit. This compares with the 60,000 pounds for the Shuttle. Adding an upper stage similar to a satellite we are building for DoD, JARVIS can launch 12,000 pounds into synchronous orbit. The JARVIS shroud is 28 feet in diameter, nearly twice the diameter of the Shuttle bay. Because the JARVIS upper stage has satellite-like qualities of maneuverability and long life, it can launch multiple satellites into a variety of orbits. It thereby preserves one of the basic ideas which underlay the Shuttle's promise to reduce costs.

The JARVIS third stage can be replaced with a CENTAUR-like cryogenic stage and the stack is capable of launching 24,000 pounds into geosynchronous orbit. This configuration is 2.5 times as powerful as Titan IV. It permits growth in the DoD, NASA, and commercial payloads of the future.

We estimate that approximately $1 billion is required to make JARVIS operational. The recurring cost for each additional JARVIS launch vehicle will be approximately $150 million. Given its lift capacity and maneuvering capability, JARVIS promises to cut the cost of satellite launches in half relative to the Titan IV or the projected ARIANE V. It would provide a modern, efficient approach to launching spacecraft. It will complement the Titan IV and Shuttle and will compete effectively with foreign launch vehicles. The capital investment, spent over three years, will represent approximately 2% of our annual expenditures on space. Given the importance of the space program to this country, we believe the investment is modest relative to the returns.

The issues surrounding the commercialization of the new ELV are the same as the ones you are addressing. Once developed by the USAF, the manufacturer could sell launches directly to the commercial sector. Or an intermediate broker may be identified who would aggregate customers, financing, and insurance. We do not prejudge the evolution of the commercialization. I can state that the probability of success of the domestic enterprise is a lot higher if the basic product is world class.

The point we are trying to make with the JARVIS initiative is simple. The country can have a world class, competitive, and powerful ELV with currently developed components. We do not have to wait ten years to get it. A JARVIS-like rocket can be ready for launch in four years. It can provide cost effective launches for DoD and NASA --- and can compete head on with foreign rockets in a free market. If we buy more Titans or Atlases or Thors with the same money, we will be no better off in four years than we are now in world class competition.

We believe that the most important role that Congress can play is to ensure that appropriate resources are allocated to the solution of this national problem. We urge that the country not undertake short term, expedient solutions. Let's do it right. We know our proposal is a challenge to the rocket industry. We mean it to be. My fervent hope is that we can stimulate bold new responses which will get us back on the track we were on a decade ago.

Gentlemen, the Challenger tragedy has crystallized the country's perception of the launch vehicle requirements. Our fundamental job is to provide assured access to space. All of us, not just the national security planners, now worry about the health of our reconnaissance, communications, and weather satellites. All of us, not just a small group of scientists, lament the lost opportunity in our generation to continue exploring the universe. For the first time, we feel the growing strength of Europe and Japan and their enthusiastic willingness to compete. We all sense the vulnerability of our leadership in space. We have had to think defensively and we do not like it. The ideas I have suggested today will enable us to get back on the offensive.

Thank you.

Mr. **Nelson**. All right. Let me see if I can summarize then what you've said.

First of all, I take it that, aside from your Jarvis proposal, that you want dual compatibility of an expendable with the shuttle so that you could use the shuttle as a backup?

Mr. **Iorillo**. Yes, sir.

Mr. **Nelson**. Would you have that, and would you intend to maintain that same philosophy if your Jarvis proposal were to become reality?

Mr. **Iorillo**. Sure.

Mr. **Nelson**. Why?

Mr. **Iorillo**. It makes common sense to have a domestic source, because I'm not sure 5 or 10 years from now what our sources will be abroad.

Mr. **Nelson**. All right.

Second, if I can summarize what you have told us, that you don't have any particular objection to NASA buying launch services to work off its backlog of Government payloads——

Mr. **Iorillo**. No.

Mr. **Nelson** [continuing]. But your conclusion is that that's not going to have a viable commercial ELV industry springing forthwith?

Mr. **Iorillo**. Yes, I guess that's my opinion, sir.

Mr. **Nelson**. OK. Let me ask you this.

What do you do now to advance your proposal?

Mr. **Iorillo**. Well, what I would like to do is encourage you, because this subcommittee I think can play a very important role in this whole affair. Specifically, I would like to encourage you to encourage the Air Force. You know, those fellows need cost-effective launch capability. They deserve a world class system as much as anybody, right? Because in the last 6 months we've all decided there is unanimity of opinion that they have the highest priority missions. They should have a world class system on which to base their future, as well.

Encourage them to move out along that path.—I think they need some encouragement.

Mr. **Nelson**. You're talking about on their MLV?

Mr. **Iorillo**. Uh-huh. You know, when the MLV program started, they were really constrained in thinking and a lot of things, just to consider getting their GPS' off the ground, their small vehicles. No one has encouraged them, "Hey, Air Force, we held you down for I don't know how many years. We finally let you have the CELV," and we recognized that that really isn't a world class system in terms of your best effort to design a new vehicle.

It is now, as Dr. Fletcher said, the premier launch system. Why? That's because with the cancellation of the shuttle Centaur, there are a number of important NASA and DOD programs that can only be launched with the Titan IV. The Titan IV is the only system that has enough capacity to get it up to synchronous orbit or high orbit. So it becomes a world class system. We ought to tell them to go out and build the best one you can, and when they get one, we'll all get one.

Mr. **Nelson**. Well, are you going to be one of the bidders in the competition on the medium launch vehicle——

Mr. IORILLO. We're under contract today as one of the people selected. But in all frankness, Congressman, we submitted the proposal knowing that it was clearly not what they had intended to buy. They hadn't ever envisioned a system like ours. We asked permission to insert it, because we didn't want to waste our money, and we were encouraged to go ahead and do it. We still don't know what we're going to do with it because there is this additional billion dollars I talked about. There is no avoiding that expenditure. The Air Force doesn't have it in their budget, and there's no POM's, so they're going to need a little help.

I believe they're the right agency to lead the way. They clearly have the critical need. It makes a lot of sense for them to be in charge of their entire system, including the launch systems, and this subcommittee can play an important role in encouraging them to move on. When they get one, we'll all have one, and you know, the issues of commercialization of this new system are going to be no different from the ones you're addressing now, if it works and it makes sense.

Mr. NELSON. How could you meet the Air Force's launch schedule requirements?

Mr. IORILLO. That's a good question. I would suggest that in order to handle the near term, it might require that the Air Force either wait for multiple-launch and GPS's on a larger booster of this type I have talked about, or buy a minimum number of small rockets, just to make up for the next couple of years if they really think it's that important to get on with it.

But the point is, if they can have a world class system in 4 years, and have to wait an extra 6 months to 1 year to get it, it may well be worth it. Now, that's something the Air Force has to consider. I tell you that we took them by surprise. They haven't had a chance to consider this option more than 9 days—they saw our proposal 9 days ago for the first time. So I'm sure there's a lot of things they have to talk about. I won't prejudge where they'll come out, but there are ways to do that. But if they spend big dollars for an MLV, whatever it is—and buy a long string—then I can tell you there probably won't be money in the constrained budgets over the next few years to do what many of us think is the right thing to do for the country in general. So I know it presents a little bit of a problem.

Mr. NELSON. Where would you launch this vehicle from?

Mr. IORILLO. You're alluding to the statements in the press.

Mr. NELSON. That's right.

Mr. IORILLO. When we started this whole Jarvis initiative, I told our people to take a fresh sheet of paper and start from scratch, examine everything without prior constraints, to see what kind of a positive suggestion we could make, including where these satellites would be launched from.

I don't think there's any question that if you have free choice and you didn't have launch bases invested in, you would launch from the Equator, out in the middle of the Pacific somewhere where you could launch north, south, east and west without constraint. You wouldn't have to dogleg to go into the polar orbits, and you could launch directly into the equatorial orbits and it would be the most efficient place to launch from.

So we examined those, to try to see whether it would be practical to put such an operation in place. In fact, I think our idea was good enough that we see that the Japanese are following us around the world. Two weeks after my colleague, Paul Visher, was on the equatorial islands, a Japanese contingent was there as well, because they have their H-2 rocket, which is a great rocket—the only problem is, they have no good launch base because it's too far north. It would behoove them, if they wanted to enter this international competition, to go to the Equator, and they might just well do that. So we examined those options as well.

We were encouraged, if this MLV were to be practical for the Air Force, to put it on Government property, so we examined Johnson Island as an alternative. There is an Air Force base there and some facilities. But the fact is, Congressman, that the Jarvis could be launched from Kennedy, it could be launched from Vandenberg. In fact, think about it. Since we're using the basic tanks from the shuttle, we're compatible with shuttle dimensions. We can use, with minor modification, the shuttle pad at Vandenberg that's being put in mothballs. What we have to do is increase the height a little bit and make provisions for a slightly changed flame bucket that would be dual compatible with both the shuttle and the others.

I'm going to let the Air Force decide where they want to launch it. That's not fundamental to the idea.

Mr. **Nelson**. Any of the committee members, Mr. Walker, Mr. Chapman? Who would like to go first?

Mr. **Chapman**. It doesn't matter. Go ahead.

Mr. **Walker**. Mr. Chairman, maybe I'm not hearing you exactly correctly, but my interpretation of what you told us here a little bit ago is that you'd rather sell to Government than to the commercial marketplace for building this rocket. Have I——

Mr. **Iorillo**. Yes, sir.

Mr. **Walker**. So that really is your position, that insofar as this proposal that you have put before us goes, you see it as being something where, rather than selling into a marketplace, you would rather have Government as your customer?

Mr. **Iorillo**. Yes, sir. I'll explain why.

First of all, it takes $1 billion to get the nonrecurring paid for before we can start having a production line. We don't think that the commercial satellite industry, the entire satellite industry in this country, can support paying for $1 billion investment at this time, and that we'd have sufficient return on the investment, even with today's low cost of money, in the whole industry to ever really get it back. The numbers required I think are substantially less than the billion dollars. So it wouldn't be a financially viable proposition on the merits of its commercial aspects.

Mr. **Walker**. Well, I also heard you say, though, that you could put this thing in orbit at about $150 million a copy?

Mr. **Iorillo**. That's our current estimate.

Mr. **Walker**. $150 million a copy, with an 85,000-pound capacity, that's not—you're shaking your head no.

Mr. **Iorillo**. Yeah. To the synchronous orbit, the capacity is about 12,000 pounds. It's 85,000 pounds into the low-earth orbit, where the shuttle bays open and put out their cargo, and that's contrasted with the 60,000 pounds that the shuttle can get to that point. But to be useful commercially, you have to get from the nominal 120-, 130-nautical-mile orbit, all the way up to the 24-hour orbit. And there we can inject 12,000 pounds, or about 4 modern satellites worth, by the way.

Mr. WALKER. OK, about four modern satellites worth, which is considerably more than the launch capacity now available, where they launch, I think, two for the most part. They can carry two at a price of $75 million is it?

Mr. IORILLO. The current prices that we're being quoted by Ariane—Whom are you talking about, Congressman?

Mr. WALKER. Well, a little bit of everything. I'm just talking generally in the market.

Mr. IORILLO. All right, let me tell you what the going rate is.

First, we were buying our launches for, the equivalent satellite I'm talking about, for about $30 or $35 million from NASA. We have recently signed a contract with Ariane. To give us an equivalent launch, they jacked up the price to about $40 or $45 million. And they're projecting that by 1990, for this half-a-vehicle's worth, they'll probably be charging $50 to $55 million. That's at the level that we think is being subsidized.

Mr. WALKER. OK. Well——

Mr. IORILLO. So we think that this, for example, in the numbers I gave you, this would be equivalent to a little less than $40 million which we think would compete just on the merits, assuming that this were a free market, by the way, with no subsidy. That's the basic assumption.

Mr. WALKER. We understand that there are some problems there, but I'm a little confused as to why, if you can be competitive in the marketplace, why you're saying that the industry then can't support the costs of building the rocket if, in fact, it is competitive in the marketplace. I mean, I thought that's how the marketplace works.

Mr. IORILLO. OK. I think I understand the question. Let me see if I can answer it.

What is the marketplace? How many launches a year is there really a demand for? I think that's the first question we have to look at.

We manufacture communications satellites of all sizes, kind of like you buy airplanes. We have our 1,500-pound variety; we have our 2,000-pound variety; and we have our 3,000-pound variety and our largest for commercial sale is of the 5,000-pound variety, and that's principally designed for a specific, special customer, Intelsat. But the normal size, the ones that we shipped out of the shuttle two and three at a time, weighed about 1,500 pounds, 2,000 pounds.

The largest year we've ever had in terms of dispensing satellites is about 12 to 15 a year, and that was one big year, and these satellites were relatively small. We don't see that the domestic requirement for launch, independent of—now I'm giving you our opinion—independent of all the forecasts, will ever amount to much more than 8 to 12 a year. These are the ones that will be available for the American ELV industry.

Now, why is that? There are more than that being built around the world. But the ones that are being built in Japan for the Japanese will be launched by the Japanese. The ones that are being built by Intelsat, a certain large fraction of those will be launched by Ariane because Intelsat has commitments in Europe. So now we're talking about those that can be launched here, and we think that that's limited to about 8 or 12 a year. Considering that's at 3,000 pounds a vehicle, that's only 30,000 pounds approximately of total injected weight. When you look at that, given the 12,000 pounds I talked about, we think that can be handled at about two to three launches of the type I talked about, and that really represents the total marketplace, in our view.

Mr. WALKER. But in addition, though, you also have some Government launches to go on ELV's, that where whoever is in the commercial area, or in the commercial arena, is going to be having launch services purchased from them by Government, there would be a variety of things beyond just that defined commercial marketplace yet.

Mr. IORILLO. Sure.

Mr. WALKER. Well—But you're telling us that, even in that kind of climate, your vehicle can't be cost effective?

Mr. IORILLO. No, our vehicle can be cost effective once the development costs are paid. It's very cost effective in that sense.

Mr. WALKER. The $150 million, does that include the development costs?

Mr. IORILLO. No, sir. That's the key, that at $150 million dollars a shot, it's a good vehicle and it would be good for 20 years, but that billion dollars up-front cost is hard to swallow.

Mr. WALKER. So you're looking for someone to underwrite the development of a new vehicle at this point is your prime point; it's not a question of whether or not a commercial marketplace might be there to do all of this work, but in terms of your particular vehicle, the commercial marketplace can't sustain that because the commercial marketplace can't pay for development up front?

Mr. IORILLO. That's right.

Mr. WALKER. Because there is no commercial marketplace?

Mr. IORILLO. Large enough to support the volume. With three vehicles a year, for example, if that's all you sold, it would take you a long time to amortize that billion dollars.

Mr. WALKER. Sure. So—but once development costs were paid for your vehicle——

Mr. IORILLO. Then it would be world class.

Mr. WALKER. And at that point it would certainly be a vehicle that could be purchased by somebody offering commercial launch services.

Mr. IORILLO. Anybody. In fact, those—the issues of commercialization are no different for this vehicle than they are with the ones you're addressing today. For example, the manufacture of a Jarvis-like rocket—and I'm not suggesting that Jarvis will win—but a Jarvis-like rocket once the Air Force got what they needed, could sell the incremental services directly to the commercial sector, or an intermediate broker could be designated which would aggregate customers, financing and insurance for the commercial sector. I won't prejudge all that.

But as I have said in my paper, I can tell you that whatever entity does get in this business, it will have a hell of a lot better chance of success if, in fact, it represents a world class product as its basis. That's the point.

Mr. WALKER. I guess, having looked at the budget constraints that we deal with and so on, my best advice to you is good luck with the Air Force.

Mr. IORILLO. Thank you very much.

Mr. WALKER. Thank you, Mr. Chairman.

Mr. NELSON. Mr. Chapman.

Mr. CHAPMAN. When you talk about the development of the vehicle itself, are you talking about, I assume, the competition between companies; when you say a collective effort, are you talking about working together to develop a particular rocket?

Mr. IORILLO. Yes, sir. There are a number of companies involved. The consortium that we've collected, that I discussed—Hughes, Rocketdyne, and Boeing as principal members—is a consortium that's been pulled together to design and develop and compete in the arena with the Jarvis rocket. There are other companies who are also competing on their own, with their own entries, and you'll hear from them in the next few days.

Mr. CHAPMAN. What kind of—do you have any feel—and perhaps someone else will address this issue—do you have any feel for the response you've received with the Air Force and what kind of time-frame or what time fuse they're on as to be able to give you some kind of idea of the depth of their interest on what you propose?

Mr. IORILLO. The depth of their interest is, again, about 2 weeks old. The first time we exposed it to the Air Force was at a private meeting with General McCartney, commander of the Space Division, and we told them what we were up to and we quite frankly admitted that this was not a medium launch vehicle by any current idea of what a medium-launch vehicle is to launch simply a GPS. And we recognized that it was a relatively bold step up. We're not sure he could handle it.

He looked at it—he's been in the rocket business for a long time; he worked on the original Titans, too, as a matter of fact, as a young engineer—and knew exactly what we were saying. He said he didn't know how to handle it but please submit it; it would be interesting to entertain in the next few months and let's see what shakes out. So we submitted the proposal.

We had done sufficient technical work—and we did quite a bit—to be awarded one of the $5 million contracts to remain in the competition, but we're still very different from all the others. And so we still have a lot of work in the ensuing months to drum up the kind of interest that I'm trying to drum up here, even within the confines of the Department of Defense.

Mr. CHAPMAN. Thank you, Mr. Chairman.

Mr. NELSON. All right. I know you need to go, but let me ask you one more question.

Since your proposal with the Jarvis launcher puts you in a new category—now you're not just a satellite manufacturer; now you're a potential ELV manufacturer—what do you think about Government assurances that would bar commercial payloads from the shuttle?

Mr. IORILLO. Oh, I guess my first reaction to that is, since I believe, if we were to invest the money in a Jarvis—if we, the country, would invest the money in a Jarvis-like booster, that it would be cost competitive enough to face even the Government competition at a reasonable rate on a shuttle. I tell you—no; I wouldn't object to the shuttle being a backup at all, or even compete at a fair price, I wouldn't be afraid of competing with that, either.

Mr. NELSON. Particularly where the price was, as we articulated earlier, where it could not be less than—

Mr. IORILLO. That's right. Yes; I'd have no problem with that, none at all.

You see, if you've got a world class product, Congressman, you can compete with anybody, if it's not being subsidized. Now, if the other side is subsidizing, it's very difficult to beat with anything, if you're just out there to sell at the lowest price.

Mr. NELSON. Was it not Alan Puckett, your CEO, that basically articulated the position that you need that dual compatibility?

Mr. IORILLO. Yes.

Mr. NELSON. Do you want to, for the record, state why?

Mr. IORILLO. The dual compatibility of being able to launch ELV's or shuttles?

Mr. NELSON. ELV's or shuttle.

Mr. IORILLO. Well, because, for example—first of all, it is our assumption—and I think it's Alan's as well—that the shuttle will remain in business for a long, long time. It's required for Government launches and it's going to be there, and that it's very reliable. Right now, even with the one accident, and with the repairs, we expect it to be the most reliable launch vehicle on Earth. We haven't yet seen a commercial ELV industry crop up. We would always think it would be prudent on any basis, because it's very simple for a system to have an accident—systems go down because of a flaw in technology or a launch is delayed for quite a bit of time because of problems.

The Titan, for example, the Titan has had two failures in a row, starting with last summer. That line is shut down. Now, if the shuttle were available in the interim to launch those satellites which were designated to be on the Titan, I think it would be prudent to have designed for that contingency. I still say, even though with an ELV—because I don't think there are going to be two or three ELV's, by the way. I mean, I've got to tell you that, too. There's not enough business to warrant just a flock of ELV companies that'll give you this wonderful internal competition. The real problem is America's ELV versus the French and the Japanese's ELV, in which case we will probably have one cost-competitive ELV, and if that goes down, it would really be nice, always, for domestic manufacturers who have services to deliver, the service companies who have services to provide, to have an alternate route. I second Alan's motion.

Mr. NELSON. Any further questions? All right. I hope you make your alternate travel arrangements.

Mr. IORILLO. Thank you very much for hearing me out and for indulging me.

Mr. NELSON. OK. Thank you. I appreciate it.

Mr. NELSON. General, thank you for being very patient. We welcome General Robert Rankine, or Rankin?

General RANKINE. Rankine, sir.

Mr. NELSON. Rankine, spelled with an "e."

General RANKINE. Spelled with an "e."

Mr. NELSON. OK, sir—Director of Space Systems and Command and Control and Communications of the Air Force. Please proceed.

STATEMENT OF BRIG. GEN. ROBERT R. RANKINE, DIRECTOR, SPACE SYSTEMS AND COMMAND, CONTROL, COMMUNICATIONS, DEPUTY CHIEF OF STAFF FOR RESEARCH, DEVELOPMENT AND ACQUISITION, DEPARTMENT OF THE AIR FORCE

General RANKINE. Thank you, Mr. Chairman. It's a pleasure for me to be here. I didn't mind at all sitting through this hearing. I found it very interesting.

I appreciate the opportunity to address the subcommittee on the important issue of commercial space launch policy. I have a written statement, which I have already provided to your staff, and I'd like to submit that for the record if I may. And I have abbreviated remarks that I'll make beforehand and then answer questions.

Mr. NELSON. Sure. Thank you.

General RANKINE. The Air Force certainly agrees with this committee's objective to stimulate the development of a commercial expendable launch vehicle industry. In the fiscal year 1986 urgent supplemental, the Congress approved the DOD plan for a medium launch vehicle [MLV] which the Air Force will use to launch global positioning system satellites [GPS], but which will also foster and facilitate, we believe, a commercial space launch capability. Since the majority of commercial payloads fall within the MLV payload and orbital launch capability, the DOD commitment to procure four per year establishes a production base to which commerical purchases can be economically added.

To further improve that economy, we will also waive the provisions of the Federal acquisition regulations for recoupment of some development costs in any subsequent commercial sales of the MLV.

As a part of the MLV proposal, each offeror—and you just heard from one—each offeror was required to address the adaptability of his MLV approach to commercial launch applications. In each of the four design contracts which were awarded just last Friday, the contractors proposed vehicles which in their own estimation could capture a good portion of the commercial launch market. Thus, we remain optimistic that our MLV program will provide one means for a U.S. commercial launch industry to compete economically in the international marketplace.

That concludes my brief remarks, Mr. Chairman. I'd be glad to answer any questions.

[The prepared statement of General Rankine follows:]

DEPARTMENT OF THE AIR FORCE

PRESENTATION TO THE
HOUSE SCIENCE AND TECHNOLOGY COMMITTEE
SPACE SCIENCE AND APPLICATIONS SUBCOMMITTEE

13 August 1986

STATEMENT OF: BRIG GENERAL ROBERT R. RANKINE
DIRECTOR, SPACE SYSTEMS AND COMMAND, CONTROL, COMMUNICATIONS
DEPUTY CHIEF OF STAFF FOR RESEARCH, DEVELOPMENT & ACQUISITION

NOT FOR PUBLICATION UNTIL RELEASED
BY THE COMMITTEE ON SCIENCE AND TECHNOLOGY
HOUSE OF REPRESENTATIVES

MR CHAIRMAN AND MEMBERS OF THE COMMITTEE:

I appreciate the opportunity to appear before you to discuss development of a commercial space launch industry. The shortfall in U.S. space launch capability since the Challenger accident and other unmanned launch failures has created uncertainty over manifesting commercial payloads on the Shuttle. The need to develop domestic commercial exploitation of space launch capabilities, technology and services for the national good has become ever more urgent. The development of commercial launch vehicles and associated services will enable the nation to maintain our space transportation leadership internationally; contribute to national security, and assure our continued access to and use of space.

Since the Challenger accident, NASA and DoD have worked closely to develop a space launch recovery plan consistent with our continuing national launch requirements. The thrust of the recovery plan is to meet DoD and NASA national space launch requirements and provide assured access to space. The DoD portion of the recovery plan calls for production of additional Titan IVs to support our heavy-lift launch requirements; development and production of a new medium launch vehicle; expansion to a dual-coast Shuttle and ELV launch capability, and modification of selected satellites enabling them to fly on either the Shuttle or ELVs.

The FY 1986 Urgent Supplemental Appropriation, which Congress approved earlier this year, supported the DoD plan for a medium launch vehicle (MLV) competition. The need for an MLV stems from the DoD requirement for a cost effective and efficient intermediate class of launch vehicles to launch the

Global Positioning System (GPS) satellites. The GPS weight and orbital requirements are beyond the small, low-altitude capability of the existing Atlas E/H and current Titan II ELVs, and the Titan 34D or Atlas/Centaur boosters offer excess performance for a single GPS satellite launch. While commercial adaptability in and of itself does not mandate that DoD develop and procure an MLV launch system, this competitive acquisition recognizes that substantial government investment can foster and facilitate a commercial space launch capability.

National Security Decision Directive (NSDD) 94 specifically prohibits the government from subsidizing the commercialization of ELVs, but does permit commercial use of government facilities, equipment and services consistent with the goal of encouraging viable commercial ELV launch activities. To this end, DoD has and will continue to support NASA and industry space launch activities from both Cape Canaveral Air Force Station, Florida, and Vandenberg Air Force Base, California.

The MLV competition should encourage a commercial space launch capability by establishing a long term MLV production rate of approximately 4 launches per year. While GPS launches are currently the only firm requirement for the MLV program, the majority of commercial payloads also fall within the MLV payload and orbital launch capability. As part of the MLV Request For Proposal, each offeror is required to detail the adaptability of the MLV system to commercial launch needs. Additionally, this competition will consider future growth and flexibility requirements to accommodate both DoD and commercial users. This task requires the offeror to describe government versus commercial priorities for personnel, contractor facilities, government facilities, and include a summary of potential commercial payloads and any changes (such as launch complex and/or vehicle modifications) to the MLV system that may be required. Establishment of the MLV production base will satisfy DoD launch requirements and should provide the means for commercial manufacturers to compete on an economic basis with foreign competitors.

To summarize, Mr Chairman: The need for an MLV system stems from the requirement to place medium size DoD payloads into orbit. While DoD is prohibited from subsidizing the commercialization of the MLV, the established production base should facilitate United States industry entry into the space launch arena. The additional commercial production will in turn benefit DoD by expanding the production base and lowering the unit cost of the launch vehicles to the government, as well as industry. Your continued support for the MLV program as part of the national space launch recovery effort will help ensure that we maintain a healthy national space program.

Mr Chairman, this concludes my remarks.

Mr. **Nelson**. OK. Members of the committee?

Mr. **Walker**. What is your guess at this point as to what your cost is going to be for a vehicle based upon a perlaunch cost?

General **Rankine**. That's difficult to answer at this stage. As you know, we're in competition——

Mr. **Walker**. Sure.

General **Rankine** [continuing]. We have a source selection situation——

Mr. **Walker**. You must have some——

General **Rankine**. And as you heard, we have quite a varied set, some which may launch individually, some which may launch two, some which may launch as many as four or six at a time. Therefore, it's going to be one of the outcomes of the design study and then a subsequent phase in which we make a final selection, cost of the launch will be one of the determining factors in the decision of which of the four contractors wins.

Mr. **Walker**. Well, let me put it this way. How much do you expect to pay for each rocket that you buy? What's your best guess at this point?

General **Rankine**. Well, sir, again, you know, is the rocket one which is large and launches six GPS's at a time, or is it small and it launches one at a time? You see, the economies are going to come out of the competition. I really am not able to answer that question until we get the results of the——

Mr. **Walker**. You see where I'm headed. I'm just trying to——

General **Rankine**. I certainly do.

Mr. **Walker**. I'm trying to figure out, from the point that you're making here about the adaptability into the commercial marketplace and so on, to give us some idea as to what this means in terms of developing a national asset. It makes all the difference in the world as to whether or not that national asset is able to compete than against other world competition and cost becomes the prime driving factor. It helps us evaluate a little more carefully if we have some ideas as to what kind of costs we're talking about as we make policy.

General **Rankine**. That's right. I understand. But the point I want to make—that's a question perhaps you ought to ask each individual contractor as they come up.

Mr. **Walker**. Yeah.

General **Rankine**. They are competing on that basis, and it's not appropriate for me during competition——

Mr. **Walker**. I just thought that you might have some general parameters that you were working with in terms of developing the proposal that would give us some ideas as to what we're doing, because if we, in fact, develop a statement that suggests that NASA ought to begin purchasing in the commercial marketplace, we probably mean that to be a policy that's going to pretty much go through the nineties. Obviously, this new vehicle is going to be a very important part of that atmosphere of the nineties, or that commercial atmosphere of the nineties, and so I was just trying to get some idea as to whether or not we're on an appropriate track or not.

General **Rankine**. I believe so, sir, because we specifically asked the contractors in the request for proposals to detail the capabilities of the launch vehicle for commercial application. In other words, what would it take in the way of launch services provided by the Government, how would that be arranged and so forth. So that is, in fact, a part of each proposal.

And from the contracts, what I can say, even though we're in competition, is that each of the contractors indicated they felt they would be able to come up with a system which would be able to compete in the international market, on that basis.

Some of the important features of being able to do that, however, are the one thing that I mentioned, and that is waiving the policy, the Government policy, which is ordinarily to go back and recoup some of the Government R&D costs on each of the commercial boosters that might come off that line later on. The Secretaries approve that. And so it's those kinds of changes, I think, that will make—whichever one wins—competitive in the market.

Mr. **Walker**. And is your intent to have a vehicle where the satellites carried to orbit could also be Shuttle compatible?

General **Rankine**. In the case of the DOD satellites, we have decided to make ours dual compatible. That's been one of the outcomes of the DOD Launch Recovery Program. And so the GPS will be able to be launched both on this medium launch vehicle [MLV] and on the Shuttle.

Mr. **Walker**. I thank you very much. We appreciate your coming today.

General **Rankine**. Thank you, Mr. Walker.

Mr. **Walker**. Thank you, Mr. Chairman.

Mr. **Nelson**. Mr. Chapman.

Mr. **Chapman**. General, are you in a position to comment on the proposal of the previous witness as to expanded and perhaps more aggressive, or what he describes as boldness—that my understanding is he said the proposal was nine days old and it's very new, in its infancy.

General **Rankine**. Well, Mr. Chapman, as I pointed out, I have to be cautious not to bias what is now a competition, a design competition, among contractors. The DOD and NASA have been jointly studying our future space launch requirements. By future, I mean beyond the current recovery issues. Where do we go next? And the results of those studies have indicated that perhaps in the mid-to late nineties we will, in fact, need a Heavy Lift Launch Vehicle.

Whether now is the time to initiate that as a part of the MLV Program is a matter which will have to be decided in the MLV competition. But I would say that eventually we will probably grow to payloads which may require that size and shape of that heavy lift launch vehicle.

Mr. **Chapman**. Mr. Chairman, that's all I have.

Mr. **Nelson**. I would like for you to comment on the proposal which is the subject of the hearing.

General **Rankine**. Mr. Chairman, most of the issues in the proposal affect primarily NASA or the Department of Transportation or both, with one exception, and that is the—your initiative number two that deals with direct versus additive cost. My staff has been together with your staff today specifically discussing that issue, and what we find is that, although we are using the term "direct" in our current internal DOD pricing policy development, when we come down to the specific definition of what's included and what is excluded, it is quite similar, almost identical to what you are proposing, or what you would like to see. So I don't believe that we have any differences in our intentions.

So I would like to side with some of the previous witnesses and say we maybe do have a problem in semantics. My staff would be pleased to work with yours in working out perhaps a better phraseology of that. But we have no differences apparently, sir, in kind.

Mr. NELSON. OK. Let me make sure I understand.

Initiative No. 1, purchase launch services of *x* number of vehicles, do you have a problem with that?

General RANKINE. No, sir. DOD would not comment on that. It involves NASA and the commercial aspects.

Mr. NELSON. OK. But the 15 launches was talking about 9 DOD Delta-class payloads, currently manifested on Titan IIs. The Air Force would or would not——

General RANKINE. Yes. Well, we're already under contract to modify those Titan IIs, sir, so that would not be a prudent thing to do, I would not expect.

Mr. NELSON. Do you want to restate that?

General RANKINE. Yes, sir. We're already under contract to modify the Titan IIs, to launch those payloads, so I would not expect that would be a very cost effective thing to do, to take those off those Titan II's.

It wasn't clear to me from your initiatives what the specific payloads were, sir.

Mr. NELSON. Well, are there any other possible payloads that you would need to utilize to—Let me see if I understand this.

You have the backup, the backlog, of Government payloads. Now——

General RANKINE. We do have a backlog of DOD payloads. The backlog of Government payloads is greater than the backlog of DOD payloads.

Mr. NELSON. All right. Are you covered now in everything in the fiscal 1986 supplemental to take care of all of your backlog of payloads you need to get up?

General RANKINE. No, sir, we'll continue to work off a backlog for some period of time.

Mr. NELSON. Would you entertain the thought of putting some of them on these launch services that NASA would acquire under this proposal?

General RANKINE. I believe that we would be willing to look at that, certainly. For example, we would like to be able to get the global positioning system [GPS] constellation up earlier than we now can, using shuttle and MLV. And if there was a third avenue, we would certainly want to look at that.

With DOD payloads, we have one problem, of course, that's different from the commercial and scientific, and that is oftentimes we require the provision of security for the payload, for the transmissions and so forth. So that would require some special study. But I think it would be very interesting and worthwhile for the Department of Defense to look into that, yes, sir.

Mr. NELSON. You don't have any idea how many?

General RANKINE. I could provide that.

Mr. **Nelson**. Would you?

General **Rankine**. Yes, sir.

Mr. **Nelson**. OK.

[The information follows:]

The GPS satellite delivery and launch schedule is described below. This delivery and launch schedule is currently under review to determine what changes should be made to minimize the impact of the shuttle standdown, reduce the backlog to a more reasonable number and allows for alternative launch methods other than the Shuttle or Medium Launch Vehicle.

NAVSTAR GLOBAL POSITIONING SYSTEM (GPS) SATELLITE DELIVERY/LAUNCH SCHEDULE

	Fiscal year—						
	1987	1988	1989	1990	1991	1992	1993
GPS satellite delivery schedule [1] [2]	6	7	7	4	4		
GPS launch schedule:[3]							
Shuttle [4]			4	6	3	2	1
Medium launch vehicle (MLV)			3	4	4	1	
Satellites available for other launch means or storage (accumulative)[5]	6	13	13	7	4	1	

[1] Satellites delivered are being produced as part of the GPS fixed price 28 satellite multiyear production contract. The schedule described is based on the contractual delivery schedule.

[2] The delivery schedule is being modified to minimize risk and cost to the government, meet the Shuttle a[illegible]launch schedule, and allow for satellite modifications for MLV compatibility.

[3] Launch schedule is based on the current DOD preliminary manifest.

[4] DOD Schedule optimized for GPS launch as soon as possible. Not likely that NASA will be able to fully accomodate. DOD–NASA negotiations on shuttle manifest are ongoing.

[5] Will change as a result of the effort to modify the satellite delivery and launch schedules (See note (2.)

Mr. **Nelson**. You don't have any problem with "additive" as opposed to "direct" cost?

General **Rankine**. That was the comment that I was making, sir. I believe that the DOD is right now using the term "direct" and, checking with your staff, we find that our intentions are identical. So we find some problem with semantics, but we find no problem with the intentions of that particular initiative.

Mr. **Nelson**. All right.

Any of the committee—any further questions?

Let me ask you, how will your MLV procurement encourage—Would you explain for the record how it's going to encourage the development of this viable commercial industry in light of the comments of Mr. Iorillo, which says that the winner of that can't be competitive in the world marketplace?

General **Rankine**. As I pointed out in my brief remarks, my understanding of the contractors who have competed in that, or are competing in that, is that they feel that providing the Government waives certain recoupments as—and I used the example of the recoupment of R&D costs—if we can waive that and other similar charges, overhead, that the cost of commercial procurement of an additional MLV off the line, in addition to those four per year that the U.S. Government would be procuring, could provide an economical and competitive, commercial launch capability.

That is their opinion, Mr. Chairman.

Mr. **Nelson**. So there's a difference of opinion there?

General **Rankine**. Yes, sir. I think you may find some different opinions as you talk to the other contractors tomorrow.

Mr. **Nelson**. OK. Any further questions? OK.

General, we appreciate your patience, have enjoyed having you here, and hope it's been profitable for you.

General **Rankine**. Indeed, it has, Mr. Chairman. I appreciate the opportunity to be here.

Mr. **Nelson**. Thank you.

General **Rankine**. Thank you.

Mr. **Nelson**. OK, let me ask up Mr. McArtor and Mr. Parker, if both of you would come to the table.

Mr. McArtor and Mr. Parker, you all have been very patient, it's late in the day, but your testimony is as valuable as it was early in the day, so we want to hear from you.

Why don't you start, Mr. McArtor.

STATEMENTS OF T. ALLAN McARTOR, SENIOR VICE PRESIDENT, TELECOMMUNICATIONS DIVISION, FEDERAL EXPRESS CORP.; AND ALAN L. PARKER, VICE PRESIDENT, EXTERNAL AFFAIRS, FORD AEROSPACE & COMMUNICATIONS CORP. AND CHAIRMAN, FORD AEROSPACE SATELLITE SERVICES CORP.

Mr. **McArtor**. Thank you, sir. Mr. Chairman, it is both a privilege and a pleasure for me to be here and once again address issues of such national significance before your committee.

I think I would like to be as brief as I can, but then to also give to you some of my personal thoughts and recommendations on your proposed legislation.

The issues that we're talking about today are essentially the same issues that we talked about the last time I had the privilege of addressing your committee—the assurance of this country's capability to have a capable, reliable, available, affordable and competitive access to space. How that's achieved, of course, is the ongoing debate.

We proposed at Federal Express a mixed fleet for some time. We provided initiative with the commercial Titan venture in 1983, a bid to launch Intelsat VI satellites on Titan 34D expendable launch vehicles. Obviously, a great deal has happened since then. Federal Express finds itself on the threshold of launching our own high-powered Ku-band satellites. The untimely *Challenger* accident, coupled with the other launch vehicle failures of late, have certainly focused attention on these issues, but the issues are basically the same. And a few basic truths remain.

One is a mix fleet is certainly better. I think we all acknowledge that now.

Two, an adequate shuttle fleet is required, but based on fleet operations of a complex aerospace vehicle and not for payload manifest pressures.

Three, the NASA is not by design an operator of scheduled events and of commercial business enterprise, nor should it be expected to be.

Four, satellite operators will seek the most competitive business package available, a business package being satellites, launch, and insurance.

Five, those aerospace corporations who have the NASA as a major customer cannot and will not have the NASA as a competitor.

Six, the cost per pound to orbit must come down, and it will come down, if the motivator is commercial competition.

Seven, the Government must assume the appropriate role of facilitator to prime the pump to provide research and development and launch pad and range facilites.

And finally, the congressional and interagency processes must begin to work positively to provide the leadership and direction necessary to get our Nation's Space Program back on a nominal trajectory and to reinstill the public confidence.

My compliments to you, Mr. Chairman, on this initiative today.

My prepared comments are rather brief, and because Mr. Parker and I sat on the same AIAA workshop and I had benefit of an advanced copy of his proposed comments, that I will simply say that I share his concerns and his recommendations and his search for priorities.

Specifically, our assessment of the space shuttle systems and the processing and operations of the shuttle, together with a renewed focus on flight safety and launch readiness signoff, make us believe that for the next 5 years the shuttle cannot be counted on for that critical feature of launch availability. There are several potential grounding possibilities for either a single orbiter or the fleet. That, coupled with the spares shortage and other operational complexities, make the shuttle, in our estimation, a nonplayer for anything other than shuttle-unique payloads, defense payloads, space station, and SDI.

We believe the shuttle fleet will average no more than four to six flights for the first 5 years—that's per year—for the first 5 years of resumed operation. And the commercial satellite program must have a date certain on which we can rely.

My amendment then to the first point of your proposal is to have NASA procure launch services for all nonshuttle unique payloads, regardless of size, for Government payloads beginning in 1988 for 5 years, or possibly for longer than that. And I believe that NASA and DOD should bear the cost of creating a mixed fleet capability for all classes of payloads—in other words, absorb certain nonrecurring costs of developing that national resource.

Regarding the access to Government launch facilities, I believe you're pretty much on target. I think the Government's responsibility is to provide launch facilities for this mixed fleet, and that the user charge should be no more significant to their business plan than a landing fee is at an airport now. I'm not suggesting the same amount of money, but no more significance in their business planning. And I think the Department of Transportation has made significant progress in understanding these issues and in putting in place operational scenarios.

As far as the pricing policy goes on shuttle, the manufacturers of ELV's tell us that they will not enter the commercial business if shuttle is a competitor, regardless of price. Now, if there is price parity, they still will not enter the marketplace. NASA once again would be a competitor as well as a customer to them.

But much confusion exists over this, and I think what is required of the shuttle pricing policy in order to guarantee that some derivative of Atlas or Titan or Delta would be marketed is still yet to be determined. And I would like to see a couple of things in this regard.

One, I'd like to see the NASA prioritize the payloads it wishes to launch, under bona fide contracts, and when it will commit to launch them. Much discussion today has been over the propriety of cancellation of contracts. I'm not sure that's the issue. I think the issue is performance on contracts. I believe that NASA is obligated to tell their customers when they will commit to launch them and then leave it to the customers to whether they wish to absorb that delay or to continue with NASA.

I'd like to see the chief executive officers of Martin Marietta, General Dynamics, and McDonnell Douglas state the ground rules they require to enter the ring, their commitment to do so, and their assessment of their vehicle's capability, availability, reliability, affordability, and competitiveness.

It is disturbing to me, quite frankly, that we are expecting a commercial program to be generated from heretofore aerospace contractors who, by and large, have no commercial products and rely on Government programs and procurements whether NASA or DOD. I truly hope these corporations accept the challenge. Their courage and willingness to develop a commercial launch program, to market that program, and to provide ELV launch services is pivotal to the legislation being contemplated by this committee.

Even though I believe shuttle to be a nonplayer in the near term for operational reasons, the ELV's apparently need an assurance of long-term, noncompetitiveness from the shuttle.

I'd like to see a couple of more things. I'd like to see the Department of Commerce take the lead in ensuring that there is sufficient insurance capability at affordable rates for commercial space endeavors. This assurance of insurance issue is a very, very serious concern. Whether the Department of Commerce or not is appropriate for that, I'd like to see the focus of an agency on that issue.

I'd like to see the pressure taken off the shuttle to maintain scheduled operations of any kind. The shuttle is an awesome technical marvel and certainly a national resource that should be judiciously used. I would allow Adm. Dick Truly to get it back in space as, if, and when he feels it's ready, without pressure from foreign or commercial customers.

I would like to see a fourth orbiter built, one built with benefit of what we've learned so far, and perhaps integrated to the space station mission.

I'd like to see a next generation ELV built whose mission is commercial, not one built in response to a Government RFP with the attendant load of nonrecurring costs and underlying Government contract infrastructure.

And finally, Mr. Chairman, I would like to see a clear, concise, aggressive, and ambitious national space policy. A substantial investment on the part of both the Government and industry will result from the announced policy. It must be established with care. The public, the space industry, and the satellite industry are willing to back a program that establishes the United States as the undisputed leader in space. We have been distracted from this as a Nation, and I think it's time to get recommitted. I look upon such a commitment as not just an opportunity, or even a responsibility, but clearly our duty.

Thank you, sir.

[The prepared statement of Mr. McArtor follows:]

TESTIMONY
OF
T. ALLAN McARTOR
SENIOR VICE PRESIDENT, TELECOMMUNICATIONS DIVISION
FEDERAL EXPRESS CORPORATION
ON THE
COMMERCIAL SPACE LAUNCH POLICY
BEFORE THE
SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
August 13, 1986

Mr. Chairman:

It is both a personal privilege and a pleasure to have the opportunity to once again address this committee on matters of such extreme national significance.

There are many processes and initiatives being pursued to further commercial space transportation and to further the technologies, skills, and operations that will encourage (and even guarantee) a viable and robust

...manned space program
...research and exploration of space programs
...space transportation
...space defense programs
...commercial space initiatives
...space station
...and other space enterprise

that will ensure that the United States maintains preeminence in space.

The issues being addressed today are essentially the same issues as those we discussed the last time I had the honor to share with this committee the philosophies and concerns of Federal Express.

This country must ensure a

...capable
...reliable
...available
...affordable
...and competitive

access to space.

August 13, 1986
Testimony of T. Allan McArtor

How that is best achieved is the ongoing debate.

In 1983, Federal Express stressed the importance of a "mixed fleet" U.S. Space Transportation System. It was our conviction as an operator of a complex aviation network and as a user of communication satellites that a single launch system was not wise...whether Shuttle or ELV's.

Federal Express provided an initiative to further such a mixed fleet concept when (in 1983) Fedex Space Transportation Company in a Joint Venture with Martin Marrietta submitted a bid to launch Intelsat VI satellites on Titan 34D expendable launch vehicles.

Obviously, much has happened since 1983. Federal Express is on the threshold of launching its own high powered Ku-band communication satellites, and of course, the Challenger tragedy coupled with the uncanny coincidental failures of other space transportation systems has focused attention on these same issues.

But the issues really haven't changed, and the Challenger accident cannot be viewed as the sole reason to reassess our national space policy. Some basic truths remain:

1) A mixed fleet launch capability is better.

2) An adequate shuttle fleet is required...but based on fleet operations of a complex aerospace vehicle and not for payload manifest pressures.

3) The NASA is not by design an operator of scheduled events and of commercial business enterprise...nor should it be expected to be.

4) Satellite operators will seek the most competitive business package available (satellites, launch, and insurance).

5) Those aerospace corporations who have the NASA as a major customer cannot...will not...have the NASA as a competitor.

6) The cost per pound to orbit must come down...and will come down if the motivator is commercial competition.

7) The government must assume the appropriate role of facilitator to "prime the pump"...to provide R&D and launch pad and range facilities.

and finally...

8) The Congressional and inter-Agency process must begin to work positively to provide the leadership and direction necessary to get our nation's space program back on a nominal trajectory...and to reinstill the public confidence.

The issues, Mr. Chairman, are still fundamentally the same.

August 13, 1986
Testimony of T. Allan McArtor

My prepared comments will be brief. I had the opportunity to review the draft comments of Mr. Alan Parker of Ford Aerospace & Communications Corporation, and inasmuch as we both participated in the AIAA workshop and had the opportunity to jointly develop several recommendations covered in Mr. Parker's report...my comments, concerns, and recommendations are substantially the same.

Specifically... I would like to address the five point plan offered for discussion by the Committee for inclusion in a bill to establish a Commercial Space Launch Policy.

Our assessment of the Space Shuttle systems, the processing, and operations...together with the renewed focus on flight safety and launch readiness sign-off...makes us believe that for the next five years, the Shuttle cannot be counted on for that critical feature "launch availability." There are several potential "grounding possibilities" for either a single orbiter or the fleet. That coupled with the spares shortage and other operational complexities make the Shuttle a non-player for anything other than Shuttle unique payloads, defense payloads, space station, and SDI.

We believe the Shuttle fleet will average no more than 4 to 6 flights per year for the first five years of resumed operations. And as you know, a commercial satellite program must have a date-certain on which it can rely.

My amendment to the proposed first point, is to have the NASA procure launch services for all non-STS-unique payloads (regardless of size) for government payloads beginning in 1988 for 5 years (or more). Additionally, NASA and DOD should bear the costs of creating a mixed fleet capability for all classes of payloads, i.e., absorb certain non-recurring costs.

Point 2. regarding access to government launch facilities is pretty much on target. I believe the government has the responsibility to create and maintain adequate launch facilities and range operations. Users should pay a nominal charge with no more particular burden than a landing fee charged at a major airport. This includes provisions for insurance and certain ground support equipment sharing.

The Department of Transportation has made significant progress in understanding these requirements and in putting in place an operational scenario.

Regarding Shuttle Pricing Policy...It is my understanding that the ELV manufacturers and the reported "offerors" of launch services would still not enter the business if STS could continue to launch commercial and foreign payloads at a price the same as the respective ELV.

Much confusion exists over this...just what is required of the Shuttle pricing policy to guarantee that a commercial derivative of Atlas, Titan, or Delta will be marketed?

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Testimony of T. Allan McArtor

I'd like to see two things happen:

1) I'd like to see the NASA prioritize the payloads it wishes to launch (under bona fide contracts) and when it will commit to launch them. The customers could decide for themselves whether to accept the delay.

2) I'd like to see the CEO's of Martin Marietta, General Dynamics, and McDonnell Douglas state the ground rules they require to enter the ring...their commitment to do so, and their assessment of their vehicle's

...capability
...availability
...reliability
...affordability
...and competitiveness.

It is disturbing to me to think that we are expecting a "commercial" program to be generated from heretofore aerospace contractors who by-and-large have no commercial products and rely on government programs and procurements whether NASA or DOD. I truly hope these corporations accept the challenge. Their courage and willingness to develop a "commercial" launch program...to market that program...and to provide ELV launch services is pivotal to the legislation being contemplated by this Committee.

Even though I believe Shuttle to be a non-player in the near-term for operational reasons...the ELV's apparently need an assurance of long-term non-competitiveness from the Shuttle.

I'd like to see a couple more things happen:

I'd like to see the Department of Commerce take the lead in ensuring that there is sufficient insurance capability at affordable rates for commercial space endeavors. This "assurance of insurance" issue is a very, very serious concern.

I'd like to see the pressure taken off the Shuttle to maintain scheduled operations of any kind. The Shuttle is an awesome technical marvel and certainly a national resource that should be judiciously used. I would allow Admiral Dick Truly to get it back in space as, if, and when he feels it's ready (without pressure from foreign or commercial customers).

I would like to see a "4th Orbiter" built...one built with benefit of what we've learned so far and perhaps integrated to the space station mission.

I would like to see a next-generation ELV built whose mission is commercial...not one built in response to a government RFP with the attendant load of non-recurring costs and underlying government contractor infrastructure.

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Testimony of T. Allan McArtor

And finally, Mr. Chairman, I would like to see a clear, concise, aggressive, and ambitious "National Space Policy." A substantial investment on the part of both the government and industry will result from the announced policy; it must be established with care. The public, the space industry, and the satellite industry are willing to back a program that establishes the United States as the undisputed leader in space. We have been distracted as a nation...it is time to recommit. I look upon such a commitment as not just an opportunity...or even a responsibility...I believe it is clearly our duty.

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Mr. NELSON. Thank you.

Mr. Parker.

Mr. PARKER. Thank you, Mr. Chairman. Thank you for the opportunity to provide comments on the potential legislative initiative and to offer suggestions which make the initiative more effective. I have submitted more detailed comments for the record.

For almost 20 years, Ford Aerospace has competed in an international commercial market for satellite programs. We have invested heavily in research and development, facilities and training, to remain competitive. Throughout this period, the U.S. Government, through NASA and the Department of Defense, has funded advanced satellite research and development programs and technology demonstrations which ultimately found applications in commercial and international satellite programs. U.S. Government involvement has clearly worked to the advantage of the Nation's satellite industry in terms of international competitiveness.

Also during this period Ford Aerospace and its customers looked to NASA or the U.S. Air Force to provide reliable and affordable access to space. It was not until the creation of Arianespace that the issue of commercialization of the U.S. launch vehicle services for commercial and foreign payloads came under active consideration.

As the United States moves forward with new launch vehicle policies, it is important to keep in mind that the United States has had in place, with NASA, a superb launch vehicle services mechanism that has worked well, extremely well, and that provided the underpinning of U.S. preeminence in space.

As we proceed into launch commercialization, certain aspects of the earlier approach should be retained for important reasons of continuity. Also, the successful commercial satellite manufacturing segment should be referenced and drawn upon as a model for U.S. launch service commercialization.

In formulating additional steps which might be taken to improve the climate for a U.S. commercial ELV business, we think it would be helpful to reflect on why the Commercial Space Launch Act has not had the intended results. In our opinion, there are three principal reasons: First, no U.S. ELV manufacturer could justify making an investment in the business given continuations of competition from NASA. The policy of pricing shuttle launches on a long-term, marginal cost basis provided no room for commercial competition.

The second reason has to do with the question of competitiveness with Ariane. Arianespace prices to recover actual recurring and operating costs. The nonrecurring costs are written off. No truly commercial company can stay in business with such a pricing policy. Apparently, it was assume in 1984—and the notion persists today—that U.S. ELV manufacturers will be able to fund vehicle upgrades and even develop new launchers while competing with Arianespace on a profitable basis. It is not all clear how the United States will become fully competitive, let alone the leader in ELV technology, without the U.S. Government taking the lead in funding new technology and development.

The third major reason has to do with—has been the response of the—has to do with the limited market or lack thereof. In the United States, we are aware of only three commercial satellites placed under full construction contract since 1982. Several others may be close to enering production, but the number is not large. Only 12 foreign satellites, not tied to foreign launch vehicles, were placed under contract since 1982. While we believe the market will improve in the nineties, it wasn't prudent for ELV manufacturers to press ahead in 1984 or 1985 to meet potential demand in the next decade, especially when there were no U.S. ELV production base to reduce startup costs and business risk.

Looking ahead, the most important factor in the outlook for U.S. commercial ELV's is the reported decision by the U.S. Air Force to acquire up to 24 medium launch vehicles for Global Positioning Satellite missions and to increase the buy of Titan IV's to 23. These actions will improve the essential ongoing production base from which commercial ELV's can be drawn. If the production base is sufficiently large, the commercial versions may have unit production cost low enough to compete with Ariane. Whether the cost is low enough to overcome the nonrecurring cost disadvantage, and also to provide a profit, is a major question.

Mr. **Nelson**. OK, sir. Let me ask——

Mr. **Parker**. I haven't finished, but——

Mr. **Nelson**. Oh, I'm sorry. I though you had. Please continue.

Mr. **Parker**. Do you have the time, sir?

Mr. **Nelson**. We'll make the time.

Mr. **Parker**. OK.

Mr. **Nelson**. If I have to——

Mr. **Parker**. I don't know what the bells mean.

Mr. **Nelson**. Well, it means that we have a vote, but I can wait about 5 minutes before I have to run over there.

Mr. **Parker**. OK. I'll be finished before then.

Before commenting on the specifics of the legislative initiative being considered by the subcommittee, I think it would be helpful to consider the planning requirements of commercial and foreign entities with respect to launch vehicles. These requirements must be satisfied in some manner prior to making major investments in satellite construction. The planning requirements are this:

One, price competition among launch vehicle manufacturers; two, ability to contract at a fixed price for a specific launch date; three, a range of payload capability to meet satellite competitive requirements; four, greater than 95 percent vehicle reliability; and five, guaranteed availability of insurance at rates reflecting historical launch experience.

The inability to cope with any of the factors results in unacceptable cost and schedule uncertainties and program risks. Legislative initiatives which positively address and meet these requirements have the best chance of stimulating the launch vehicle business because they will meet the needs of launch services customers, the owners of satellites.

With respect to the potential initiatives, we agree with the list of "givens" as far as they go. Reliable access to space for all users should be the goal and a mixed fleet of shuttles and ELV's is required to accomplish this goal. America cannot concede the commercial launch services market to foreign competition because of the loss of U.S. revenues, the migration of control over satellite design parameters, and the loss of national prestige. Also, keeping commitments to those who have made progress payments on firm contracts to use the shuttle is clearly the right thing and honorable thing to do. No company or nation should breach a contract without expecting to pay a price for that action in either financial or reputational terms, or both.

However, from a practical standpoint, this can only mean that the affected commercial and foreign payloads would be offered shuttle launch dates on a space-available basis. With the uncertainties surrounding shuttle launch schedules, few if any of those holding contracts will be able to live with this schedule uncertainty and they will no doubt arrange for launches on U.S. ELV's or Ariane. Some already have. If those holding shuttle contracts wish to cancel, NASA should accept and return all payments promptly.

Now, the question then becomes a matter of what the U.S. Government can and should do to accomplish the objective of providing a climate in which U.S. commercial ELV's can be competitive. I would like to comment on the legislative initiatives one by one.

Initiative 1. We endorse the notion of NASA procuring launch services for Government payloads and regard this to be a very innovative approach. Presumably, the NASA order could be added to the DOD requirements with resultant economies of scale. A key underlying assumption is, of course, that Government science and applications payloads not requiring use of the shuttle would be flown on ELV's. This is an important change from past assumptions which had all such payloads flying on shuttle.

We question, however, legislating the number, capability and launch rate of the launch services to be procured by NASA. We would suggest an alternative approach: direct NASA to complete study requirements and formulate an ELV acquisition plan to meet its launch needs. Also, as part of this study, we believe NASA, in conjunction with the Air Force, should complete a detailed analysis of near- and long-term ELV development efforts required to achieve U.S. and ELV leadership and make the appropriate funding requests for ELV launches and research through the budgeting process.

Initiative 2. We support the change to provide access and use of Government launch facilities at additive rather than direct cost. Apparently we made certain assumptions. Additive to us means incremental; direct would mean more of a total, fully accounted basis, on a shared basis. The U.S. Government will benefit from the additional launch activity and higher ELV production volumes.

Initiative 3. We support repricing shuttle launches but prefer to see the shuttle price change to one that recovers full cost less development, rather than one that equals a comparable ELV launch.

Initiative 4. The provision to divert revenues to the general fund would not be required if the recommendations made with regard to repricing the shuttle are accepted. The higher shuttle price would, by itself, discourage the shuttle use.

Initiative 5. We support the "Underwriters Laboratory" concept. However, there presently is no impediment which we are aware that prevents private insurance underwriters or brokers from performing the function on their own initiative. The insurance industry has the option of withholding coverage unless risks are addressed properly.

In our opinion, these legislative initiatives, with the modifications suggested, would provide a basis for commercialization of ELV launches. But of equal or perhaps greater importance, the initiatives provide a way to build upon U.S. Government, non-DOD requirements for ELV-compatible payloads while maintaining NASA's active participation in the launch process. NASA's involvement would provide a backstop should reconsideration of comercialization effort be necessary.

There is one other important aspect, and that is the matter of launch insurance. Launch insurance is not available commercially today at rates which reflect historical U.S. experience and that which is available cannot be obtained until just before launch. Business and foreign entities require quantification of costs and risks prior to making the substantial investments required in the satellite system.

Ford Aerospace has proposed the U.S. Government establish a federally chartered insurance corporation at no cost to the Government. The corporation would provide insurance for U.S. launches at rates based on historical experience, plus premiums, to build a reserve pool and to pay for administrative costs. The corporation would initially be capitalized by the U.S. Government and, following a startup period, convert to a public stock company. We urge the subcommittee carefully review the insurance aspects of launch services business and either to address the matter of this legislative initiative or be prepared to consider additional legislation if lack of insurance and high costs prove to be major impediments to a commercial ELV program.

Thank you for the opportunity to comment on the potential legislative initiatives and to share our views.

[The prepared statement of Mr. Parker follows:]

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TESTIMONY
OF
ALAN L. PARKER
VICE PRESIDENT, EXTERNAL AFFAIRS
FORD AEROSPACE & COMMUNICATIONS CORPORATION
AND
CHAIRMAN, FORD AEROSPACE SATELLITE SERVICES CORPORATION
ON
COMMERCIAL SPACE LAUNCH POLICY
BEFORE THE
SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
AUGUST 13, 1986

Mr. Chairman, thank you for the opportunity to provide comments on the potential Commercial Space Launch Policy legislative initiative the Subcommittee is considering and to offer suggestions which might make the initiative more effective.

By the way of introduction, it may help the Subcommittee to understand the vantage point from which my comments are offered. As Vice President, External Affairs for Ford Aerospace & Communications Corporation, a wholly-owned subsidiary of Ford Motor Company, I have overall responsibility to direct the company's business development activities, including those of our satellite manufacturing business. As Chairman of Ford Aerospace Satellite Services Corporation, I have had the opportunity over the last four years to direct development of a detailed plan to enter the domestic U.S. commercial satellite services business. These positions provide insight into the planning and decision making processes of U.S. and international organizations which own or plan to own communications satellites and the impact of launch services issues on these businesses.

Ford Aerospace designs, develops and manufactures communications satellites, weather satellites and other satellite payloads for the U.S. government, commercial and foreign customers. Ford Aerospace, one of the pioneers in the industry, built the first active repeater satellite, Courier, which was launched over a quarter century ago. Since that time Ford Aerospace has built more than 80 satellites, almost all of them of the geostationary type. These include all three generations of NATO satellites, five U.S. weather satellites, six satellites for Japan, three for India, three payloads for Arabsat and all fifteen of the INTELSAT V and VA satellites. Among Ford Aerospace's current satellite programs are the next generation of U.S. weather satellites for NOAA and two high-capacity satellites for Japan.

For almost 20 years, Ford Aerospace and our able U.S. competitors have competed in an international commercial market for these satellite programs. We have invested heavily in research and development, facilities and training in order to be able to remain competitive in U.S. and abroad and meet commitments to our customers. Throughout this period the U.S. government, through NASA and the Department of Defense, has funded advanced satellite research and development programs and technology demonstrations which ultimately found applications in commercial and international satellite programs. U.S. government involvement has clearly worked to the advantage of the Nation's satellite industry in terms of international competitiveness.

Also during this period, Ford Aerospace and its customers looked to NASA or the U.S. Air Force to provide reliable and affordable access to space. We worked closely with U.S. government agencies to make optimum use of available launch vehicles, to support launch activities and to design new satellites in response to evolving launch vehicle capability. It is notable that the launch vehicle segment of the U.S. space business did not develop a commercial element in the same way that the satellite manufacturing segment had. This of course, was for several very good reasons, the most important of which is the requirement in the launch business for very expensive launch and range facilities. However, it was not until the creation of Arianespace, the quasi-commercial European launch service company, that the issue of commercialization of U.S. launch vehicle services for commercial and foreign payloads came under active consideration. As the U.S. moves forward with new launch vehicle policies, it is important to keep in mind that the U.S. has had in place, with NASA, a superb launch vehicle services mechanism that has worked well, extremely well, and that provided the underpinning of U.S. pre-eminence in space. This is not to suggest that we necessarily change this approach, but rather, as we proceed into launch commercialization, certain aspects of the earlier approach should be retained for important reasons of continuity. Also, the successful commercial satellite manufacturing segment should be referenced and drawn upon as a model for U.S. launch service commercialization.

In formulating additional steps which might be taken to improve the climate for a U.S. commercial ELV business, we think it would be helpful to step back and try to determine why the Commercial Space Launch Act (P.L.98-575) of 1984 has not had the intended results. In our opinion, there are three principal reasons. First, no U.S. ELV manufacturer could justify making an investment in the business given continuation of direct competition from NASA, and the government backed Arianespace. Had the 1984 legislation been accompanied by a change in pricing policy to one of full cost recovery less development versus the long-run marginal cost formula, we think a different ELV business might exist today. In our view, it isn't necessary to ban commercial and foreign use of the Shuttle to prompt ELV commercialization as some have suggested. Rather, if the Shuttle price were based on realistic estimates of orbiter life, maintenance requirements, flight rate, spares, etc., ELV's will almost certainly turn out to be a less expensive means to orbit.

The second reason the 1984 law may not have achieved desired results has to do with the question of competitiveness with Ariane and other foreign launch alternatives. It is not clear that U.S. commercial ELV's can be price competitive with Ariane. Despite charges by Arianespace that Shuttle prices were "subsidized", in fact so are Ariane's. In the past Arianespace has met and bettered the Shuttle prices. Today, Arianespace is taking advantage of the delay and potential unavailability in shuttle launches by raising their quotes to levels previously considered unreasonable or unacceptable. In any event, when competition again presents itself, Arianespace will price primarily to recover their actual recurring and operating costs (which continue to be subsidized by about 30 percent of ESA's total yearly budget). The non-recurring costs will have long before been written off. No truly commercial company can stay in business with such a pricing policy. Apparently it was assumed in 1984, and the notion persists today, that the U.S. ELV manufacturers will be able to fund vehicle upgrades and even develop new launchers while competing with Arianespace on a profitable basis. This is an assumption that should not be taken on faith. While we are not privileged to data which demonstrates that the non-recurring hurdle can be overcome, the issue is so basic to U.S. policy and legislation that it deserves very careful investigation.

This brings me back to the earlier point about using the satellite manufacturing business as a model for the ELV business. In the past, present and hopefully into the future, NASA has funded advanced satellite technology programs including demonstrations. The technology, once proven, can then be incorporated in future government or commercial satellite designs. Also, the Department of Defense satellite programs provide a technology development base that can be drawn upon over time for commercial applications much as has occured in the aircraft industry. The U.S. ELV manufacturers will have the ability to build on DoD production requirements and on the NASA base should the House initiative proceed. However, it is not at all clear how the U.S. will become fully competitive, let alone the leader, in ELV technology without the U.S. government taking a lead in funding new technology and development. In our opinion, it is doubtful the ELV manufacturers can do it on their own and be price competitive with Ariane and other potential launch service suppliers. The price of a 100% commercial launch services experiment could be the U.S. falling still further behind in launch capability.

We believe that the third major reason there has been little response to the Commercial Space Launch Act has to do with the market or lack thereof. In the U.S., we are aware of only three commercial satellites placed under full construction contract since 1982. Several others may be close to entering production but the number is not large. Twelve foreign satellites, not tied to foreign launcher vehicles, were placed under contract since 1982. Of these fifteen satellites, two have already been launched on Shuttle, seven are under contract or awarded for launch on Ariane, two have been launched on Ariane and four are not yet under launch contract.

The point is that the commercial and foreign market is limited and subject to peaks and valleys. We believe the market will improve in the 1990's but it wasn't necessary or prudent for ELV manufacturers to press ahead in 1984 or 1985 to meet potential demand in the next decade.

It is our view that the U.S. commercial and foreign satellite markets are likely to remain limited. Launch costs and insurance rates have soared, and the effects on U.S. transponder pricing has yet to be felt. The adverse effects on user demand of price increases and alternative transmission paths, such as fiber optic cables, may be very significant. Presently, there are 27 commercial satellites in orbit serving the U.S. Another 28 satellites are authorized by the FCC for construction and launch. Of those authorized satellites, Ford Aerospace projects that 13 eventually will be built and launched. Most of the contracts to launch these will be let in 1987 for launches in 1990 and 1991. Another wave of potential U.S. satellite launches will occur in the 1992 to 1995 period as 19 satellites launched in the 1982 to 1985 period reach the end of life. We do not expect all of these satellites to be replaced; however, if they were, the replacement and launch vehicle decisions will have to be made in 1989 and 1990. These unit volumes while not large but nevertheless represent a sizable incremental business opportunity to U.S. ELV manufacturers which will already be in production to meet U.S. government requirements.

In the international arena, INTELSAT has become increasingly active in seeking to meet the emerging domestic and international telecommunications needs of its members. This heightened market responsiveness will tend to dampen the growth of the market for national and regional satellite systems but will sustain requirements for new INTELSAT capacity. An offsetting factor is that transoceanic fiber optic cables probably will dampen the growth of INTELSAT traffic overall.

While these factors will retard development of a U.S. commercial ELV business, conditions have changed since the loss of Challenger. The most important change thus far is the reported decision by the Air Force to acquire up to 24 medium launch vehicles for Global Positioning Satellite missions and to increase the buy of Titan 4's to 23. These actions will provide the essential on-going production base from which commercial launchers can be drawn. If the production base is sufficiently large, the commercial versions may have unit production costs low enough to compete with Ariane. Whether the cost is low enough to provide a profit and also to overcome the non-recurring cost disadvantage is a major question which only the ELV manufacturers can answer. Also, there is the question of technical competitiveness with Ariane. Will the U.S. commercial derivatives of launchers designed to meet U.S. government requirements be competitive? It is not yet possible to tell since neither firm launch prices nor specifications are available from U.S. manufacturers.

Notwithstanding the restart of U.S. ELV production lines for government payloads, as long as the present Shuttle pricing policy remains intact, it is doubtful that the ELV manufacturers will make investments in the business. Even if they could compete on price, it is unrealistic to think that the ELV manufacturers would wish to compete with NASA which is at the same time a customer and on which they would depend as a supplier of launch facilities and related services. We believe any U.S. government policy or legislation which does not clearly eliminate these issues is unlikely to be successful in stimulating a U.S. commercial ELV industry.

Before commenting on the specifics of the legislative initiative being considered by the Subcommittee, I think it would be helpful to consider the planning requirements of commercial and foreign entities with respect to launch services. These requirements must be satisfied in some manner prior to making major investments in satellite construction. The planning requirements are as follows:

1. Price competition among launch vehicle suppliers.
2. Ability to contract at a fixed price for a specific launch date.
3. Range of payload capability to meet satellite competitive requirements (equivalent of upper and lower Spelda on Ariane IV).
4. Greater than ninety-five percent vehicle reliability.
5. Guaranteed availability of insurance at rates reflecting historical launch experience.

The inability to cope with any of the factors results in unacceptable cost and schedule uncertainties and unacceptable program risks. Legislative initiatives which positively address and meet these requirements have the best chance of stimulating the launch vehicle business because they will meet the needs of launch services customers, the owners of satellites. These planning requirements are taken into account in our comments on the potential legislative initiatives.

Ford Aerospace had the opportunity to participate in the ELV workshop conducted in June by the AIAA at the request of Chairman Fuqua. A report on the workshop proceedings was presented to this Subcommittee on July 25, 1986 by Dr. John M. Logsdon. We support the recommendations included in the AIAA report. It is interesting and encouraging to note that the legislative initiatives under consideration reflect the findings of the ELV workshop. In particular, we agree with the "Givens" as stated in the Subcommittee's Commercial Space Launch Policy as far as they go. Reliable access to space for all U.S. users should be the goal and a mixed fleet of Shuttles and ELV's is required to accomplish this goal. America cannot concede the commercial launch services market to foreign competition because of the loss of U.S. revenues, the migration of control over satellite design parameters and the loss of national prestige. Also, keeping commitments to those who have made progress payments on firm contracts to use the Shuttle is clearly the right and honorable thing to do. No company or nation should breach a contract without expecting to pay a price for that action either in financial or reputational terms or both. Having said this, however, it is important to define the implications of honoring the contracts. From a practical standpoint, this can only mean that the affected commercial and foreign payloads would be offered Shuttle launch dates on a space available basis. With the uncertainties surrounding Shuttle launch schedules, few if any of those holding contracts will be able to live with this schedule uncertainty and they will no doubt arrange for launches on U.S. ELV's or Ariane. Some already have. If those holding Shuttle contracts wish to cancel, NASA should accept and return all payments promptly.

In our review of the "Givens," it became apparent that there were other "Givens" which should be considered for addition to the subcommittee's list. The "Givens" we suggest be added reflect our position that the Shuttle be treated as a unique U.S. strategic advantage; our concern that commercialization of ELV's may take priority over the objective of assured access to space; and questions about the near and long term competitive viability of a U.S. commercial ELV industry organized as a completely stand-alone enterprise. The suggested additions to the "Givens" list are as follows:

1. The Shuttle is a scarce national resource to be conserved for high priority, manned missions.

2. The U.S. government should fund research and development of ELV's sufficient to assure near and long term competitiveness of U.S. ELV's in a manner similar to NASA support of advanced satellite technology. The efforts should focus in improved safety, reliability and reduced cost.

3. Until commercialization of U.S. ELV's is proven, continued involvement of the U.S. government to assure availability of ELV's for commercial and foreign users is required. This sustained involvement would position NASA to step in to provide launch services should commercialization falter.

4. The U.S. government should aggregate NASA and DoD ELV-compatible launch requirements to establish a large and on-going production base upon which a commercial ELV industry can be built.

5. The U.S. government should take actions necessary to promote the commercial availability of launch insurance at rates which reflect the excellent historical U.S. ELV experience.

Overall, the "Givens" as stated in the Policy initiative and those suggested as additions by Ford Aerospace flow from common concerns. The U.S. must act to assure a U.S. ELV capability is restored as soon as possible for a wide range of unmanned launches, and some level of commitment by government to make sure it is successful is essential.

The question then becomes a matter of what the U.S. government can and should do to accomplish the objective of providing a climate in which U.S. commercial ELV's can be competitive. First, as you have requested, I would like to comment on the potential legislative initiatives the Subcommittee has put forth in the order listed:

1. **NASA must purchase, through a competitive procurement, at least 15 launches (not vehicles) capable of placing up to 2800 pounds in geosynchronous transfer orbit for government payloads aggregated by NASA. These launches should be purchased over a 5 year period beginning in 1988 and should occur at a rate of at least 2 per year.**

   We endorse the notion of NASA procuring launch services for government payloads and regard this to be a very innovative approach. Presumably the NASA order could be added to DoD requirements with resultant economies of scale. A key underlying assumption is, of course, that government science and applications payloads not requiring use of the Shuttle would be flown on ELV's. This is an important change from past assumptions which had all such payloads flying on Shuttle. Also, the proposition has several other attractive features. It guarantees a minimum number of launches and keeps NASA directly involved and committed to the ELV program including maintenance of the ranges and safety and, therefore, enhances the probability of commercial success. In the event the commercialization program were to falter, NASA would be positioned to step in and provide launch services.

   We question, however, legislating the number, capability and launch rate of the launch services to be procured by NASA. As written, the initiative would serve to re-establish Thor-Delta availability while almost 70 percent of the 50 payloads manifested on the Shuttle would exceed 2,800 pounds to geosynchronous transfer orbit. We would suggest an alternative approach; direct NASA to complete a study of requirements and formulate an ELV acquisition plan to its launch needs. Also, as part of this study, we believe NASA in conjunction with the Air Force, should complete a detailed analysis of near and long term ELV development efforts required to achieve U.S. ELV leadership and make the appropriate funding requests for ELV launches and research through the budgeting process. We believe this effort would result in a recommendation by NASA to purchase Medium Launch Vehicles rather than Deltas.

2. **The Commercial Space Launch Act (P.L. 98-575) should be amended to provide access to government launch facilities at additive rather than direct cost.**

   We support the change to provide access and use of government launch facilities at additive rather than direct cost. The launch facilities will be maintained to meet government requirements and only incremental costs associated with commercial use should be charged. The U.S. government will benefit from the additional launch activity and higher ELV production volumes.

3. **The Shuttle Pricing Policy for foreign and commercial users (Title II, P.L. 99-170) should be amended as necessary to have the price for a Shuttle launch be not less than the price for a comparable U.S. ELV launch. NASA should continue to provide incentives for research use of the Shuttle through the Joint Endeavor Agreement program. Special cost arrangements (e.g., deferred payments of launch costs) should be continued, when appropriate.**

   We can support the potential initiative as stated but prefer to see the Shuttle price changed to one that recovers full cost less development rather the long-run marginal cost. This would place Shuttle pricing on the same footing as ELV's and would discourage consideration of the Shuttle's use for commercial and foreign launches, even as a back-up vehicle. This recommendation is in line with our position that the Shuttle capability should be preserved for high priority, manned payloads.

4. **To discourage NASA from active pursuit of commercial customers for the Shuttle, all revenues obtained from foreign and commercial Shuttle users which exceed the full cost of providing the service (currently estimated at $74 million in 1982 dollars) will revert directly to the general fund of the U.S. Treasury.**

   The provision should not be required if the recommendations made with regard to point 3 above are accepted. The higher Shuttle price would by itself discourage its use. An alternative could be to designate receipts from any commercial and foreign launches to ELV research and development.

5. **It is the sense of the Congress that the private insurance industry should be encouraged to establish an "Underwriters Laboratory" equivalent which would monitor ELV quality assurance and reliability. Such an organization would assist in more accurately assessing risk and thus minimizing risk exposure.**

   We support the concept, however, there presently is no impediment of which we are aware that prevents private insurance underwriters or brokers from performing the function of an "Underwriters Laboratory" on their own initiative. The insurance industry has the option of withholding coverage unless risks are addressed properly in the manufacturing and launch phases of satellites and launch vehicles. Ford Aerospace has in place rigorous quality control and review

> procedures as part of our commitment to customer satisfaction. We accommodate in-depth scrutiny by our customers and cooperate fully with the insurance industry. In any case, we look to NASA and the Air Force to continue to set standards for launch safety and other launch requirements which must be part of any licensing process.

In our opinion, the potential legislative initiatives, with the modifications suggested, would provide a basis for commercialization of ELV launches. But of equal or perhaps greater importance, the initiatives provide a way to build upon U.S. government, non-DOD requirements for ELV-compatible payloads while maintaining NASA's active participation. NASA's continued and enthusiastic involvement is important. NASA has years of experience and an outstanding track record which should be employed in the commercialization process. And their involvement at every step in that process would provide a back-stop should reconsideration of the commercialization effort be necessary.

From our standpoint as satellite designers, developers and manufacturers, we are prepared to work directly with U.S. commercial ELV suppliers and to assist our customers in doing so. We have years of experience with NASA, DoD and Arianespace. A major negative impact on the satellite industry would occur if U.S. ELV commercialization does not work and the West is left with one launch service supplier.

There is one other very important aspect of the commercial and foreign satellite business which is not dealt with in the potential legislative initiatives, the matter of launch insurance. Today, launch insurance is not available commercially at rates which reflect historical U.S. ELV experience and that which is available cannot be obtained until just before launch. Businesses and foreign entities require quantification of costs and risks prior to making the substantial investments required in a satellite system. Insurance costs and availability are major deterents to growth of the satellite industry. Perhaps commercial underwriters will respond to a restart of U.S. ELV's with lower rates and advance commitments. We have our doubts. Perhaps the ELV manufacturers themselves will provide substantial coverage. This remains to be seen.

Ford Aerospace has proposed, and several major companies have supported creation by the U.S. government of a commercial space insurance program through establishment of a Federally chartered insurance corporation. The corporation would initially be capitalized by the U.S. government, and following a start-up period, convert to a public stock company. The corporation would provide insurance for U.S. launches at rates based on historical experience plus premiums to build a reserve pool and to pay for administrative costs. Any draw-downs prior to adequate funding of the pool would be an interest bearing debt of the corporation to the government. The proposal is explained in some detail in the attachment hereto.

We urge the Subcommittee to consider carefully the insurance aspects of the launch services business and either to address the matter in this legislative initiative or be prepared to consider additional legislation if lack of insurance and high costs prove to be major impediments to a commercial U.S. ELV program.

Our final point: reestablishing a U.S. ELV capability is a matter of urgency to Ford Aerospace and, we suspect, other satellite manufacturers. Planning and implementing a commercial satellite system takes between 5 to 8 years. At this juncture only Arianespace is quoting firm launch prices, firm terms and conditions and firm insurance rates; and only Arianespace will commit and contract to firm launch dates. There is no U.S. competition and the knowledge of and confidence in other launch alternatives is low. Satellite owners cannot and will not wait for the U.S. to make up its mind what to do. Witness the recent decisions by two Japanese companies and the Government of India to launch in total 5 U.S.-built satellites on Ariane rockets. These satellites were planned for launch on U.S. vehicles and are lost opportunities from the U.S. standpoint. In a business in which the base is shallow and erratic, the loss of these launches has already taken a heavy toll on U.S. launch vehicle commercialization. Thus, we urge the U.S. government to act quickly, be it through legislation or executive order or both, to assure that a U.S. launch program is restored to provide reliable access to space for all U.S. and foreign users.

Thank you for the opportunity to comment on the potential legislative initiatives and share our views.

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ATTACHMENT

PROPOSAL FOR A U.S. COMMERCIAL SATELLITE LAUNCH INSURANCE PROGRAM

Background

Inadequate availability of insurance for commercial satellite launches and excessive insurance premiums are jeopardizing the future of the U.S. commercial satellite industry. Efforts to reestablish a U.S. expendable launch vehicle capability for commercial satellites will be unsuccessful unless insurance issues also are resolved. The loss of eight insured communication satellites during the period 1983 - 1986 (coupled with the recent, highly publicized but uninsured losses of Challenger, two Titan rockets and one Delta rocket), has placed the commercial space industry into disarray. From 1977 to 1985, insurers paid claims of approximately $900 million compared to net premium receipts of $445 million resulting in a loss ratio of approximately 200%. During the 1983-85 period, the loss ratio was 330%. The insured loss of Ariane V18 on May 30, 1986, could result in complete withdrawal of insurance coverage for commercial launches.

The recent loss experience does not accurately reflect U.S. and foreign launch vehicle performance over the past 25 years, when U.S. ELV's were in regular production and launches were frequent. The exhibit shows the generally excellent experience of the four principle U.S. launch vehicles. The performance of the European Ariane launch vehicle series is also noted.

The recent losses have had two major impacts: premiums (including post check-out life insurance) have increased to levels which bear no relationship to historical loss experience; launch insurance capacity has declined dramatically, if it is now available to all. In 1983, launch premiums of 5 to 6% were paid; in late 1985 quoted premiums were in the 25-30% range. Prior to the May 30 Ariane launch, insurance capacity had declined from an estimated $125 million per launch to between $50 and $60 million, and premium rates, policy terms and coverage amounts were not available until 90 days prior to the scheduled launch date.

The inability to secure adequate insurance at historically based rates has a particularly deleterious effect on U.S. communication satellite owner/operators and, in turn, on U.S. satellite manufacturers. Commercial investment in space is characterized by a front loaded risk profile. Projects involve a long construction period (3-4 years) and high capital investment is required before space assets become revenue producing. In this unusually risky environment, commercial investors must have a reasonable assurance of profits and return on investment. History shows that they are willing to take market risks, but they cannot tolerate cost uncertainty (i.e. launch insurance premium rates) or inadequate or no insurance when the satellite reaches the launch pad. Commercial satellite operators now face $300 to $500 million investment decisions without any assurance that coverage will be available at the time of launch, and with no certainty of insurance premium rates. In the case of those projects funded with third party financing, loans would not be available in the absence of insurance or investor guarantees. Based on recent quotations, insurance, already the third largest cost component of a commercial satellite project, is approaching the cost of the launch services. Unless a solution is developed, the future supply of U.S. commercial satellites is jeopardized.

A decline of the U.S. commercial satellite business would have adverse effects on U.S. national interests. Not only will U.S. leadership in the peaceful use of space decline, but derivative technical and economic benefits to the United

States would be lost. Notwithstanding an action by the U.S. which would reestablish ELV capability, as other countries continue to develop launch capability supported by insurance programs, the launch vehicle business would emigrate from the United States. Eventually, the manufacture of commercial satellites and other space hardware would follow.

Recommendation

The U.S. Government is urged to consider creation of a commercial space insurance program as an integral part of the program to reestablish a U.S. expendable launch vehicle capability. In this conjunction, it is recommended that the U.S. Government create an entity to provide commercial launch insurance to stimulate and sustain the development of a U.S. expendable launch vehicle capability.

This is how such a program could work. The U.S. Government entity would make asset value based launch insurance coverage available upon signing an agreement to procure launch services from a U.S. supplier (3-4 years prior to launch). Premium rates would be based on the historical loss ratio for a particular launch vehicle plus an administrative premium (0.5% - 1.0%) and a reserve fee (2% - 3%) designed to form a loss reserve pool in the event future loss experience proves to be worse than historical loss ratios. The administrative premium would be designed to cover the cost of administration of the insurance program. Premium rates would be indexed to the overall historical loss ratios rather than recent experience but would be revised to include additional success or failure experience on a moving average basis.

The following is an example calculation of a launch insurance premium rate assuming a commercial payload launch today on an Atlas G/Centaur (historical loss ratio information is provided in the Exhibit):

	Launch Insurance Premium Rate (Through 120 Day Commissioning Period)
Historical Loss Ratio (Total Mission Sequence)	15.4%
Administrative Premium	0.5 (EST.)
Loss Reserve Pool Fee	2.0 (EST.)
Total Atlas G/Centaur Launch Insurance Premium Rate	17.9%

Launch insurance capacity would be defined to include the value of the following assets (prior to the declaration of the satellite as operational):

- Satellite
- Launch Services
- Mission Operations
- Apogee/Perigee Stages
- Launch Insurance Premiums
- Interest During Construction

The proposed program would be provided under the auspices of a Federally chartered corporation, initially capitalized by the U.S. Government which would convert at the expiration of a transitional period to a public stock corporation similar to COMSAT Corporation and the Federal National Mortgage Association. This program would not require subsidy of the commercial space insurance nor create a permanent government presence in the insurance business.

This proposal is intended to be a conceptual outline and many policy issues and details must still be addressed. These include:

- Allocation of insurance premium rates through each of the following launch and commissioning phases:
  - Low Earth Orbit (LEO)
  - Geostationary Transfer Orbit (GTO)
  - Geostationary Orbit
  - Completion of Satellite On Orbit Test and Check Out
- Evaluation of an alternative concept to fund the reserve pool through a portion of revenues earned by satellite owner/operators whose spacecraft are successfully launched.
- A schedule of rates related to deductibles to be assumed by satellite owners and hardware suppliers.
- Rates for all-new launch vehicles and stages.

Summary

It is proposed that the program to reestablish a U.S. ELV capability include the assured availability of adequate launch insurance capacity at rates based on historical experience for all commercial satellite missions. If launch insurance capacity continues to be inadequate and launch insurance premium rates remain at the present unjustifiably high levels, efforts to reestablish a U.S. ELV capability for commercial launches probably will be unsuccessful. The proposed insurance program would result in no cost and minimal risk to the U.S. Government, would protect the viability of the commercial space industry and would stimulate commercial use of U.S. expendable launch vehicles.

Prepared by:

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Exhibit

PROPOSAL FOR A U.S. COMMERCIAL SATELLITE LAUNCH INSURANCE PROGRAM
HISTORICAL SUCCESS AND LOSS RATIOS BY LAUNCH VEHICLE

Vehicle	First Launch	Number of Launches	Launch Vehicle Failures	Launch Vehicle Success Ratio	Other(1) Failures Through Commissioning Phase (First 120 Days)	Total Mission Sequence Success Ratio (Aggregate)	Total Mission Sequence Historical Loss Ratio (Aggregate)
GEO Transfer Orbit							
Delta	1960	179	12	93.3%	6	89.9%	10.1%
Atlas/CENTAUR	1962	65	9	86.2%	1	84.6%	15.4%
Subtotal GTO Launch Vehicles		244	21	91.4%	7	88.5%	11.5%
LEO Orbit							
Titan III & 34D	1966	134	5	96.3%	-	96.3%	3.7%
STS	1981	25	1	96.0%	4	80.0%	20.0%
Subtotal LEO Launch Vehicles		159	6	96.2%	4	93.7%	6.3%
Total U.S. Launch Vehicles		403	27	93.3%	11	90.6%	9.4%
Memo:							
Ariane	1979	18	4	77.8%	2	66.7%	33.3%

(1) Includes Apogee failures for GTO Launches and Apogee/Perigee failures for LEO Launches.

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Mr. **Nelson**. Thank you.

What do you feel about policy that prohibits or bars commercial satellites from the shuttle?

Mr. **Parker**. Are you directing it to——

Mr. **Nelson**. Both of you.

Mr. **McArtor**. I'll take a shot at that first.

I don't like the idea of having to legislate that or to make that kind of policy. I think it's—I think all of these proposals for legislation, though, are not "stand alone" issues—the cancellation of contracts, barring commercial payloads from shuttle, use of launch facilities, et cetera.

If the national interest is going to be served by a mixed fleet, and if the mixed fleet is going to be provided by the private sector, then what are the things that have to be done in order to get to that point? And if one of those is to take commercial payloads off shuttle so that you can encourage an ELV industry, that may be a price to pay. But it would be an unfortunate policy to have to say across the board.

Quite frankly, I think that in light of the shuttle's difficulty in its ability to recover, particularly now with three orbiters, that it would suit the Government and NASA, as well as DOD, to procure launch services for all their commercial payloads and in that manner honor their contracts.

Mr. **Nelson**. Mr. Parker.

Mr. **Parker**. If the repricing is undertaken, as we have proposed, we don't think that it's really an issue, nor necessary to take that action. I think it would take place on its own for economic reasons. Users of, owners of commercial communication satellites and foreign manufacturers are heavily driven by price as well as reliability, of course, but the cost of launches is of overwhelming importance. And if it were repriced, I think it's largely a moot issue from our standpoint. So I don't think we would focus on that.

And with regard to the backup aspects——

Mr. **Nelson**. You're the first person that's said that all day, and I think that you're accurate in saying that.

We're going to have to go run. I have about three more questions to ask you, so if you all could just sit tight, I'll——

Mr. **Parker**. We'd be happy to.

Mr. **Nelson** [continuing]. Punch in over there and be right back. We'll stand in recess.

[Whereupon, the subcommittee was in recess.]

Mr. **Nelson**. OK. Here we are, 6:22 in the evening.

If you had a situation where you did not bar commercial satellites from the shuttle because of the backup, and therefore it would be left to companies who make the satellites dual compatible, if that were the case, who do you think should bear the cost of making those satellites dual compatible?

Mr. **Parker**. Let me, as a representative of a satellite manufacturer, say how we would approach compatibility.

We cannot ever look at a market in such a limited way that our satellites would not be potentially used in some derivative form for either a commercial or a Government payload. We design specifically for the widest possible application. We would never design a satellite—I say never; certainly not—I can't see us doing that in the next 5 years—which would lock out the use of either shuttle or an ELV. It wouldn't be prudent for us to do that.

Then the principal consideration on that is form, meaning volume, not weight necessarily, or exactly how the propulsion system works, but it really means form and fit so that you would lock yourself either out of ELV's or out of the shuttle. So that would be a going-in design parameter. Anything we would do would be cross-checked on both of those sides.

Mr. **Nelson**. All right. Is that a lot more expensive than just designing a——

Mr. **Parker**. It needn't be, sir, it needn't be. Designing so that you're ready to go on either way——

Mr. **Nelson**. Right.

Mr. **Parker** [continuing]. Would be expensive, because in the case of the shuttle versus an ELV, you must acquire an upper stage to get you from low earth orbit into geostationary transfer orbit, and that bill could be anywhere from, depending on the source, from $5 to $15 million. You would not purchase that capability if you had a commitment to fly an ELV.

And this is where the issue of compatibility for a backup comes into play. It's important, I think, to understand what that means in practical terms.

Should an ELV suddenly become nonavailable from the United States, the first thing you would do is to—the first action you would take is to see what other ELV would be available in the United States; let's say there are two, an Atlas/Centaur and a Titan for larger vehicles. You might be able to pick up a ride there, or Ariane could be a backup.

Now, failing either one of those, the issue you then look at is the possibility of going on the shuttle. But it's not a very attractive possibility in that circumstance, not because the shuttle isn't attractive, but because you would have a minimum of perhaps an 18 months to 2 year wait for an upper stage to be constructed. So does it really provide a backup? Again, it may be one of these sleeves out of the best moot issues from the standpoint of real practical terms, and that's why the offering up of the shuttle on a backup basis to an ELV is not particularly significant to us.

I hope I've answered your question.

Mr. **Nelson**. All right. Why is—I wish the Hughes Aircraft gentleman were here. Why is Hughes a lot more concerned about this dual compatibility than you, then?

Mr. **Parker**. I can't answer for them, of course. I could only speculate that they have made an investment in two satellites, one of which they presumably did on their own funds, and the other as part of a Government contract, which are optimized for the shuttle. They have integral upper stages. They can fly on expendable launch vehicles I am informed by taking the upper stage out. But it is a special consideration.

There also may be some assumption in their position relative to the continuation of existing shuttle prices. And that is primarily where the advantage might flow from to them.

Mr. **Nelson**. In what you just described as the Hughes payload, is that—in the lingo of the business, would that be considered a shuttle-unique payload?

Mr. **Parker**. The only use satellite of which I'm aware that is truly unique is called the Syncom IV. It's the LESAT which has been sold as a semicommercial operation, the capacity to the U.S. Navy for communications. That is 14 feet in diameter and it cannot fly on any other ELV in production or available today. I understand it could fly, however, with perhaps some structural modifications on a Titan IV with the Centaur stage and a larger faring.

Mr. **Nelson**. All right. Let me ask you this question. Thank you, and you've clarified a number of these items.

You see what happens when the Department of Defense bill gets on the floor.

Under this proposal, in which I enunciated the different initiatives, NASA could charge no less for the shuttle than a comparable U.S. ELV launch.

Now, would it be fair, in your opinion, to expect commercial customers, with existing contracts to fly on shuttle, to pay a higher price for currently—to fly on an ELV—no, to fly on the shuttle.

Currently people have an existing commitment to fly on shuttle. Under the proposal of this initiative, we're talking about that the shuttle would have a higher price than an ELV, so presumably, the shuttle price would ratchet up. All right.

The question is—I would like both of your opinions—would it be fair to then to ask them to pay that higher price from what they now have as a launch commitment?

Mr. **McArtor**. In my opinion, clearly no. A deal is a deal. A guy's got $30 million launch on shuttle and he's been making progress payments against that, he ought to go on shuttle for $30 million.

The problem is, when will that happen. I think it's NASA's obligation to tell that particular customer when will that launch occur, and make a commitment in that regard. I think we'll find that there are an awful lot of people who think they're No. 1 on the dance card, and when they finally get their priority published, they may find that 1994 and 1995 is not an acceptable date to wait for the $30 million launch. They may choose other alternatives, but it would be their choice.

But I think as far as should they honor a contract, and should they honor a price, clearly yes. I mean, that's part of the business world, is that some people get in on the deal and some people don't.

Mr. **Parker**. I feel the same way, Mr. Chairman, that a deal is a deal, a contract is a contract, should they wish to wait for that available space. But again, we place high emphasis on meeting the shuttle-unique type of payloads which have national priorities over a commercial satellite launch, quite frankly, and I think the Nation has to look at it that way.

And because of that, it seems to me that a commercial company, or a foreign government, that needed a communications satellite in orbit in 1987, and was faced with the prospect of waiting possibly to 1990, couldn't be so cavalier about that to wait for that price and it wouldn't be justified to do so because of all the ground networks, the telephone systems—and I think India is a recent case in point. They had a contract to fly on the shuttle, they have now arranged to fly that payload on the Ariane. They will not wait for that.

On the other hand, I think we should promptly and without question return their funds, if they're requested. Now, I think there is some authorization required to do that, because there is no methodology that I'm aware to return those progress payments. In some cases they're quite high.

Mr. McArtor. Just one other observation on pricing. To price the shuttle identical to the equivalent ELV launch is not the only issue. The terms of launch, relaunch capabilities or relaunch guarantees and other features of the launch service agreement are as important or certainly as significant as the price and would, in fact, shuttle be marketing—would they be selling in the marketplace shuttle capacity. That's one of the things that the ELV operators, I'm sure you'll hear tomorrow, are very sensitive about. So pricing is only a way to say will there be competitive launch service agreements on terms and price in the marketplace with shuttle and the ELV providers.

Mr. Nelson. OK. Now, let me have your opinion about sunset, that the requirement to fly on a commercial ELV, or the encouragement—the policy put forth in this proposed legislation—that that would sunset if, after a number of years, that no such viable ELV industry were to arise; what do you think about that—arbitrarily stating that in the legislation with a set number of years.

Mr. McArtor. My observation is that that could easily be a self-fulfilling prophecy. The NASA has within its—I don't want to sound particularly paranoid here, but I think the NASA has within its capability to keep a viable ELV industry from forming if they can be in the marketplace selling launch services. So the sunset provision, obviously, if the policy isn't working, whether you've got a sunset provision written into it or not, I presume we'd be back in this Chamber and we'd be talking about other alternatives and if it's not working, we'll fix it. So I'm not sure that it's even necessary to worry about if something isn't happening 3 to 4 or 5 years from now would we do something different. I would certainly anticipate that we would be doing something differently anyway.

Mr. Parker. It all depends on how close we are to sundown. If sundown is of December 31, of this year, then I could warm to the idea of a sunset, or earlier. I think if this legislation, or whatever we need to do, it's got to happen quickly. There is only one place we can get a firm launch contract, only one, and that is with Arianespace—a firm price, a firm commitment, terms and conditions, insurance included, partial, is one place.

Now, if that is early enough and we get the structure set, and you can go to the Titan people, Martin Marietta or General Dynamics or McDonnell Douglas, and get a contract, a launch services contract, and sign up within the next 6 months, then you might have something. But if it doesn't happen then, then I think the U.S. Government better turn on its heel and find out how it's going to fix this thing without depending on what is essentially an untried experiment.

I don't want to demean the idea of commercialization because we're ready to deal with General Dynamics and others, and so is Mr. McArtor. Let's see what the terms and conditions—let's see the price, let's see the insurance. That's what we've got to see. Otherwise, we only have one other place to go.

Mr. **Nelson**. Well, you all have been very helpful. Thank you for your patience today. It's been a good educational experience for this committee. We appreciate it.

The meeting is adjourned.

[Whereupon, at 6:35 p.m., the subcommittee was adjourned.]

DEVELOPING A U.S. ELV CAPABILITY

THURSDAY, AUGUST 14, 1986

House of Representatives,
Committee on Science and Technology,
Subcommittee on Space Science and Applications,
Washington, DC.

The subcommittee met, pursuant to call, at 1:45 p.m., in room 2318, Rayburn House Office Building, Hon. Bill Nelson (chairman of the subcommittee) presiding.

Mr. Nelson. The subcommittee continues today its hearings to discuss a new legislative initiative, one which would encourage the development of a commercially expendable launch vehicle capability in this country.

We started off yesterday, and it was highlighted, that this capability is vital if the country is to maintain its preeminent position in space exploration.

Yesterday the subcommittee heard the reaction of Government witnesses and private sector spacecraft providers to a number of these legislative policy initiatives. And so we are looking forward today to the reaction of expendable launch vehicle manufacturers and potential providers of ELV services.

This subcommittee is unwaivering in its commitment to maintain the strength of America's space program. And we have tried to demonstrate the intensity with which we feel what I just said by virtue of the action of the remarkup of the NASA authorization bill this morning which continued on into this afternoon.

We simply are not going to allow the erosion of our leadership by foreign competition. That is felt unanimously by all of the committees in Congress dealing with America's space program.

Now, that's why we are considering this legislative initiative to make changes in the policy, so that we can ensure this leadership. So we welcome you today.

We have Mr. Brackeen from Martin Marietta; Mr. Rector from General Dynamics; Mr. Ordahl from McDonnell Douglas; Mr. Dealy from Transpace Carriers; and Mr. Koopman from American Rocket Co. So we welcome you all and we will just take you in the order as listed on the witness list on the agenda.

Mr. Brackeen?

STATEMENTS OF RICHARD E. BRACKEEN, VICE PRESIDENT, SPACE LAUNCH SYSTEMS DIVISION, MARTIN MARIETTA DENVER AEROSPACE; WILLIAM F. RECTOR III, VICE PRESIDENT, PROGRAM DEVELOPMENT, GENERAL DYNAMICS SPACE SYSTEMS DIVISION; CHARLES A. ORDAHL, VICE PRESIDENT, ENGINEERING AND OPERATIONS, McDONNELL DOUGLAS ASTRONAUTICS CO. JOHN F. DEALY, SENIOR ADVISOR TO THE BOARD OF DIRECTORS, TRANSPACE CARRIERS, INC., AND GEORGE A. KOOPMAN, PRESIDENT, AMERICAN ROCKET COMPANY

Mr. BRACKEEN. Thank you, Mr. Chairman, and members of the subcommittee:

I welcome the opportunity to come here today and respond to your—to your questions. Thank you.

I am going to synopsize briefly from my written statement if you—if you agree. And I have divided these comments into three basic parts. I have kind of a general statement first on your questions about the viability of a U.S. expendable launch vehicle industry.

I am going to give you, secondly, just a brief overview of the current family of Titan launch vehicles we are building because that indeed is the basis for our willingness to offer such a launch vehicle commercially. And then I will get to some specific comments on the initiative that you have provided to us to study.

In the—in the commercial context, as you know, we have been asked by Congress and the executive branch on numerous occasions of our willingness to offer a commercial version of the Titan if the Government were to alter its policy for launching commercial and foreign payloads on the shuttle. Our answer is yes.

The Commercial Space Launch Act of 1984 provided a good framework to encourage the private sector to develop a viable and competitive space launch industry. I think today we are seeing it perhaps didn't go quite far enough. But we do believe that legislation provides the necessary framework for the commercial launch industry if the Government decides in some way to limit commercial and foreign payloads on the shuttle.

The strength and growth of a commercial industry, we believe, can best be served by a clear and prompt articulation of the national policy for commercial shuttle flights. We think the users of commercial launch vehicles would be well served by what we think would be a competitive environment that would emerge. That competitive environment, I think, was indicated pretty well in the recent DOD competition for the first phase of a new medium launch vehicle—the MLV.

In that competition, as you—as you may know, four initial contracts have been awarded to McDonnell Douglas, to General Dynamics, to Martin Marietta, and to Hughes. An interesting aspect of that competition, I am sure you know, has requirements that include commercial applicability to the one you propose.

Moreover, we believe that an American commercial ELV industry can be established without subsidy. We have not anticipated requesting any—any new subsidies, and we are confident of our ability to compete with any free enterprise, unsubsidized system.

Your comments about foreign competition are very pertinent. Competing with Ariane will be a challenge. And you must know we have given a great deal of study to that. But given the current market backlog, given our knowledge of the Ariane production and launch limitations and constraints, and perhaps more importantly, giving—given the—the emergence of new and competitive space initiatives for the European Community of Nations that fund ESA, we believe that the Ariane challenge can be met successfully by the American launch vehicle industry.

Let me say a word or two about our current programs because we are currently benefiting from a very certain future in the manufacture and launch of certain members of the Titan family.

As you know, we are in various stages of production and development on three Titan space launch systems. Our major development is the Titan IV—previously we called it the complimentary expendable launch vehicle. The Air Force awarded—actually last year we finalized negotiations of the basic contract to Martin Marietta as the prime contractor, and our team of major subcontractors. This original contract was for building and flying 10. This procurement was driven by the national security requirements for assured access to space. And actually I think our purpose here today is to make sure that that same assured access is available to the commercial payload community.

The Titan IV team is broadly based, and I am proud that most of us are here at this table. We are prime contractor—and General Dynamics, as you know, will produce for us the very essential high energy upper stage. McDonnell Douglas will provide payload farings. Hughes-Delco will provide for us the guidance. And, of course, United Technologies Corp. and Aerojet Tech Systems will produce the solid rocket motors and the liquid engines for the Titan IV.

The Titan IV is being designed as a shuttle equivalent booster for geosynchronous payloads. It will—it will place 10,000 pounds into a geosynchronous orbit. It can also launch about 40,000 pounds into a low-Earth park orbit due east.

We have a fixed price contract. It's for the production of—of 10 Titan IV's through 1993. The first launch is going to be in the fall of 1988. And, of course, you know that Congress has approved the procurement of an additional 13 Titan IV's.

Let me move now to the Titan II. We recently definitized our contract for the Titan II. In that program we are going to refurbish Government-owned Titan II ICBM's for use as space launch vehicles. In this effort, of course, we are going to incorporate the much upgraded technology of the Titan III program as it has been upgraded over these 20-some odd years.

The Titan II space launch vehicle is designed to place very small payloads up to, say, 4,000 pounds into low Earth polar orbits. It's contemplated to be flown out of the west coast. Again, we have a fixed price contract there. The initial contract calls for our refurbishing eight, with an option for five more, and that vehicle will fly first in April of 1988.

Mr. **Nelson**. That was the Titan II?

Mr. **Brackeen**. That was the Titan II.

Mr. **Nelson**. And you have a contract with the Air Force already in place?

Mr. **Brackeen**. Yes.

Mr. **Nelson**. For eight of those——

Mr. **Brackeen**. Yes.

Mr. **Nelson** [continuing]. To be refurbished?

Mr. **Brackeen**. Yes.

Mr. **Nelson**. When was that contract signed?

Mr. **Brackeen**. We have been under a letter contract for some time while we definitized it and we agreed on the final terms early this week, and it may be signed by today. But it's contemporaneous with these testimonies.

Our third major effort is the operational Titan III space launch vehicles, the current version of which we call the Titan 34D. This is designed with its third stage, the transtage, to take Government payloads to geosynchronous orbit. More importantly, for today's purposes, I will say it can place nearly 34,000 pounds into low Earth orbit.

The Titan III provides great flexibility to us and to the Nation for payloads in the—in the payload class greater than the Titan II and, of course, smaller than a Titan IV.

Mr. **Nelson**. Now, what you are referring as the III is actually the 34D?

Mr. **Brackeen**. Yes.

Mr. **Nelson**. OK.

Mr. **Brackeen**. Titan 34D.

The Titan 34D has a potential, we think, to assist in the—in the recovery and—and the space launch backlog for many Government and civil payloads. We are currently—we are currently responding to many Government requests from the Air Force and NASA to assess the capability to launch payloads such as TDRS, Skynet, DSCS III on the Titan III.

In addition, the Titan III is a viable competitor to the Ariane 3 and 4 launch vehicles. And as we have said in the past, it can launch dual commercial payloads. It, in fact, is a version of the Titan III that we have been at work on for some time to offer a commercial dual launch, not unlike the Ariane 3 and 4 family.

In closing on that part of the discussion, the Titan family of expendable launch vehicles does provide a wider range of capability for assured access to space. They are an existing, proven, realistic solution to—to some of the civil and—and DOD, as well as commercial backlog the Nation now faces.

Let me really turn to the purpose of your inviting me here today. I want to address some of the specific questions and statements you made in your—in your legislative initiative that you gave to us.

I would like to say that the recent Airlie House workshop sponsored by this committee gave many of us the first opportunity to sit face-to-face and discuss these issues. You probably heard it was a wide ranging—maybe you heard a candid—and productive discussion. It was certainly productive for me—very useful. And as a matter of fact, my comments today incorporate some new insights I gained from that meeting.

In that light, and on behalf of Martin Marietta, I'd like to say we really welcome your initiative and these hearings to assure that the United States does retain our preeminence in space.

To begin with, obviously, you know we manufacture many elements of the shuttle and we are a proud member of the space shuttle team. We are doing everything we can to encourage and assist the quick return of the shuttle to operational status and we are sure hopeful that the Nation will proceed with a replacement orbiter.

We agree with your—your axiom that the Nation should have a mixed fleet of launch vehicles composed of the shuttle for—for all missions, and a family of ELVs.

It is true, in the post-*Challenger* period, that the basis for launching commercial satellites on the shuttle has drastically changed, of course, in terms of the number of orbiters available, flight rates that we'll be able to achieve, total flights that will eventually be available, and, of course, things like priority for commercial launches.

I guess it's our view that the shuttle, especially during this—this period of reduced availability, should be used for missions that exploit its truly unique capabilities.

Now, if the objective is to assure that a competitive ELV industry does emerge, it follows that no artificial incentives should be offered by the Government for commercial operators to use the shuttle for non-Government payloads.

With respect to your questions honoring, or concerning the honoring of existing commitments to launch commercial payloads on the shuttle, we certainly understand the motivation and the—and the—and the very tough issue there.

That desire, however, appears to be inconsistent, or really tough to achieve in view of your objective to provide a maximum incentive and encouragement to the commercial ELV industry.

A clear and unambiguous policy on this matter would benefit—would be a tremendous benefit to both the commercial payload community as well as the launch vehicle industry.

We would agree, however, that the shuttle should remain available to commercial users as a backup vehicle of last resort.

I might say parenthetically, this is the insight I gained as I sat and listened to those tough issues being discussed at the Airlie House.

Relative to your—your idea of directing NASA to competitively purchase 15 launches over a 5-year period, I must admit that we are not well versed that there are that number of payloads in that class range that you cited. But I think we see the intent you had in mind and, of course, we believe that's probably an appropriate issue for NASA to discuss with you and perhaps with the DOD. Should you decide on such a course, I can assure you we'd be very happy to compete in that competition providing, I think, the lowest possible price to—to the NASA, and perhaps a mission-by-mission competition would be easier than trying to order 15 at once. But I would leave that to the NASA.

Mr. **Nelson**. Well, that number 15, you know, came out of your discussion at Airlie House. And it was comprised of 6 civilian payloads—Government payloads—that were a backlog, and 9 DOD payloads that were a backlog, of which you are now telling us that you are already under contract for providing the Titan II for 8 of those 9. So that's a new piece of information.

Mr. **Brackeen**. I see. I have to say, I'm not certain that we're speaking of the same payloads. And I would be very happy to provide for you, after the hearing, the specifics of that—of the Government plans for those eight.

I think the—there's—there's value in the idea, however.

We would agree that to promote a commercial ELV industry, Government services and facilities should be made available on an additive cost basis. We've been very happy to see a few public comments to that effect recently.

In reference to your question and statements about shuttle pricing, I think the issue was—was fairly well covered in the—in the testimony yesterday. I had an opportunity of an hour or so to go to look at some of that.

I guess I would say it—it does appear that shuttle pricing algorithms should be reevaluated in the context of the—the shuttle recovery efforts and the constrained availability that I alluded to earlier. It is true, you have observed correctly, that the private sector has tried several times to develop a commercial launch vehicle industry, and you say there is none today.

In each case, I think it's fair to observe that private industry has simply been unable to compete with the Government-established shuttle prices. The single most important barrier to prior attempts to develop this industry has been the shuttle pricing policy.

As—as an article in the—in the Wall Street Journal observed just a couple of days ago, perhaps the most significant action that the Government could take to stimulate this commercial ELV industry would be to articulate a new shuttle pricing and use policy for commercial payloads.

It is—it is this certainty that we all need, both the commercial space users community as well as the ELV community, on which to base our investment decisions.

We believe that simple step would be the important mechanism needed to fully implement the intent of your 1984 commercial space launch legislation.

With those use and pricing policies I just described, we feel confident that market demand and competition would establish a true economic price for commercial customers. Parenthetically, I'd be surprised if that commercial price were a great deal different from the price being charged by Ariane today.

If, however, at sometime in the future, as some have suggested, this approach—these ideas you're exploring—should ultimately be seen as not serving the best interest of the Nation, it would certainly be appropriate to revisit this—perhaps articulate a different policy. And part and parcel of what I've just said, of course, includes retaining the space shuttle as the launch vehicle of—a backup launch vehicle of last resort for the commercial launches.

We would—we'd certainly agree that continued encouragement must be given to promote research and development uses of the shuttle, and we would really support continued special cost arrangements for things like the joint endeavor agreement programs, like the phoresis R&D, because that's the very thing the shuttle can do that no other device in the world can do, and we should encourage its use in that sense.

You asked a question about insurance. I would say that broadly your question about an underwriter's laboratory idea did come up at the Airlie House. We'd be quite happy to have such additional certainty available, not only to the users of an expendable launch vehicle, but to ourselves. And so we'd be quite happy to—to cooperate with whatever makes sense there.

With respect to insurance in general, there are a number of ideas being discussed. And one that I think is a very thoughtful approach for a possible Government incentive there was the idea put forth by Mr. Alan Parker yesterday. And we are exploring, as you might guess, ideas of that nature as well as what participation we as a launch vehicle manufacturer could bring and help. I believe, first, we should try to ask the industry to solve this problem on their own. But we're—we're certainly of a cooperative nature there, and seek to find a solution. We believe a solution can be found.

Let me summarize saying a little bit about the Titan series. It has been in production for about 30 years and each succeeding generation has been, as I said earlier, improved by incorporating the technological changes and improvements that the Government felt were—were appropriate and beneficial for each of the members of the Titan III.

The Titan family of contractors are well established. They have a very positive and certain outlook, which is one of the conditions, I think, that the commercial space users seek. The business, as I said earlier, that we have in the backlog will offer ongoing contracts running well into the 1990's.

But the family of launch vehicles I've described exist now, it meets all the requirements that we can see for many current or anticipated commercial payloads. And we don't seek any subsidies, any guarantees of developments to offer that commercially.

As we—as we contemplated over the last several months offering a commercial version of the Titan, it never dawned on us to ask the Government to pay us the investment to get into the business. However, we do need some certainty of what that market outlook will be as a basis for our financial decisions.

We believe that competition for commercial payloads is going to be very beneficial to the Government in the launch vehicle prices for future Government payloads. We think it's—and especially in this era—given the budgetary considerations that you people face every today, it would be wise to try to relieve the budgetary burden on the taxpayer by commercially funding commercial ELV's for commercial payloads. Competitive pressures are going to assure the lowest possible prices and the best operational and technical efficiencies.

Many have talked about the short-term backlog and demand for launch vehicles. I think it's fair and it's appropriate for me to say that we would agree with some comments we read in yesterday's testimony, that the long-term commercial ELV marketplace may not be large. Recent indications are that, however, there are three or four or five of us that are going to compete in the good old-fashioned American way to provide launch services, not only for the DOD and MLV, but for commercial users.

I've told my management that all of us most certainly won't survive—perhaps one or two. But I will tell you, we believe that there will be a strong surviving American ELV capability if initiatives that you are considering are enacted.

At risk and the potential rewards of success, after all, though, are the basic fabric of what competitive enterprise is all about.

So we stand ready if you—if you desire now, to take any questions that you might have about the testimony.

[The prepared statement of Mr. Brackeen follows:]

TESTIMONY OF RICHARD E. BRACKEEN, VICE PRESIDENT MARTIN MARIETTA DENVER AEROSPACE BEFORE THE SPACE SCIENCE AND APPLICATIONS SUBCOMMITTEE OF THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY

AUGUST 14, 1986

Mr. Chairman and Members of the Subcommittee:

I welcome this opportunity to come before you today. I have divided my opening comments into three parts. First, I will comment on the viability of a U. S. expendable launch vehicle industry. Secondly, I will discuss the current Titan programs. Thirdly, I will comment on the legislative initiative this subcommittee is considering.

In the commercial context, as you know, we have been asked by Congress and the executive branch about our willingness to offer a commercial version of the Titan if the government were to alter its policy for launching commercial and foreign satellites on the shuttle. Our answer is yes. The Commercial Space Launch Act of 1984 (PL 98-575), encourages the private sector to develop a viable and competitive commercial space launch industry. We believe that legislation provides the necessary stimulation for the commercial launch industry if the government decides to limit commercial and foreign payloads on the shuttle. The strength and growth of that industry can best be assured by a clear--and prompt--articulation of the national policy for commercial shuttle flights. We believe the users of commercial launch vehicles will be well served by the competitive approach indicated in the recent DoD competition for a new medium launch vehicle (MLV) for the Navstar satellite. In that competition, four initial contracts were awarded (to Martin Marietta, General Dynamics, McDonnell Douglas and Hughes) for this ELV for which the requirements include "commercial applicability". Moreover, we believe that an American commercial ELV industry can be established without subsidy and we would not anticipate requesting a government subsidy. We are confident of our ability to compete with any unsubsidized system. Competing with Ariane will be a challenge but given the current market backlog, Ariane production limits and emerging, competitive space initiatives in Europe, we believe we can meet that challenge successfully.

With regard to our current programs, we are in various stages of production and development on three Titan space launch systems. Our major development effort is the Titan IV, (previously called the Complementary Expendable Launch Vehicle). Last year, after a competitive procurement, the Air Force awarded Martin Marietta and its subcontractor team a contract for the development and production of a complementary expendable launch vehicle for launching shuttle equivalent payloads. This procurement was driven by the national security requirement for assured access to space.

The Titan IV team is broadly based, with Martin Marietta as the prime contractor, and principal subcontractors that include McDonnell Douglas and General Dynamics in addition to United Technologies, GM-DELCO Systems, and

Aerojet Tech Systems. The Titan IV can place a 10,000 pound payload in geosynchronous orbit or a 32,000 pound payload in low earth polar orbit. Our present fixed price contract calls for the production of 10 Titan IVs through 1993 with the first launch scheduled for October, 1988. As you know, Congress has approved the procurement of 13 additional Titan IVs.

Next, we are under contract to the Air Force to refurbish government owned Titan II ICBMs for use as space launch vehicles. In this effort, we incorporate the upgraded technology of the Titan III program. The Titan II space launch vehicle can place payloads weighing up to 4,200 pounds into a low earth polar orbit. Martin Marietta's fixed price contract calls for eight vehicles with an option for five additional vehicles to be refurbished from the government inventory of 56 decommissioned Titan II ICBMs. The first Titan II ELV scheduled launch is in April, 1988.

Our third major effort is the operational Titan III space launch vehicle, the Titan 34D. It can place 4,200 lbs. in geosynchronous orbit and payloads ranging up to 33,600 pounds in low earth orbit. The Titan III provides flexibility to the nation for payloads between Titan IV and Titan II class launch vehicles. It provides a potential government launch alternative for spacecraft such as the TDRS and has the potential to launch dual government payloads such as Skynet and DSCS III. In addition, the Titan III is a viable competitor to Ariane 3 and 4 launch vehicles and can launch dual commercial payloads. Thus, the Titan family of expendable launch vehicles provides an assured access to space and an existing, proven and realistic solution to the shuttle manifesting backlog the nation now faces for government as well as commercial payloads.

Finally, I would like to address issues raised in the legislative initiative this subcommittee is considering. The recent Airlie House workshop sponsored by this committee provided the first opportunity for many government and industrial interests to discuss in an open forum many of the issues of concern to us all. Wide ranging and productive discussions were held that were important to both government and the commercial space launch industry. It was, I believe, a most useful forum. My comments today incorporate the insights many of us shared during those discussions

In that light, and on behalf of Martin Marietta, I welcome these hearings to assure that the United States retains it's pre-eminent position in space. As you know, we manufacture many elements of the shuttle and its ground support systems. Martin Marietta is a proud member of the space shuttle team. We encourage the quick return of the shuttle to the family of American space launch vehicles and we remain hopeful that the nation will proceed with a replacement orbiter. We agree with your axiom that the nation should have a mixed fleet of launch vehicles composed of the shuttle and a family of ELVs. In the post-Challenger period, the basis for launching commercial satellites on the shuttle system has drastically changed in terms of the number of orbiters, flight rate, total flights, availability and priority for commercial launches. The shuttle, especially during this period of reduced availability, should be used for missions that exploit its truly unique capabilities. If the objective is to assure that a competitive commercial ELV industry emerges, then it follows that no artificial incentives should be offered by the government to use the shuttles for non-government payloads.

With respect to your question concerning honoring existing commitments to launch commercial payloads on the shuttle, we certainly understand the motivation. However, that desire appears to be inconsistent with your objective to provide incentives and encouragement to the commercial ELV industry. A clear and unambiguous policy on this matter would be a benefit to the commercial payload community as well as the launch vehicle industry. We would agree, however, that the shuttle should remain available to commercial users as a backup vehicle of last resort.

Directing NASA to competitively purchase 15 launches over a five-year period may help alleviate the ever more rapidly accumulating backlog of government payloads. We would be happy to participate in such competition and suggest that those launches be competed on a program by program basis so that payloads and launches can be matched in the most cost and technically effective manner. Perhaps NASA and other government users of launch services could make cooperative use of DoD ELV assets in the same manner as NASA provides shuttle launch services to other government users.

We do agree, that to promote a commercial ELV industry, government services and facilities should be made available on an additive cost basis.

In reference to your question, it would appear that shuttle pricing algorithms should be re-evaluated in context of the shuttle recovery efforts, constrained availability and planned future usage. The private sector has tried several times to develop a commercial launch vehicle industry. In each case, private industry was unable to compete with government established shuttle prices. The single most important barrier to prior attempts to develop a commercial ELV industry has been the shuttle pricing policy. As the Wall Street Journal recently suggested, the most significant action the government could take to stimulate a commercial ELV industry would be to articulate new shuttle pricing and use policies for commercial payloads. We believe that this simple step would fully implement the intent of your 1984 commercial space launch legislation.

With the use and pricing changes suggested above, we believe market demand and competition will establish a true economic price for commercial customers. If, however, as some have suggested, this approach should ultimately be seen as not serving the best interests of the United States, a further re-evaluation of shuttle use policy and pricing would certainly be appropriate.

We certainly agree that continued encouragement should be given to promote research and development uses of the shuttle, and would support continued special cost arrangements for the joint endeavor agreement programs.

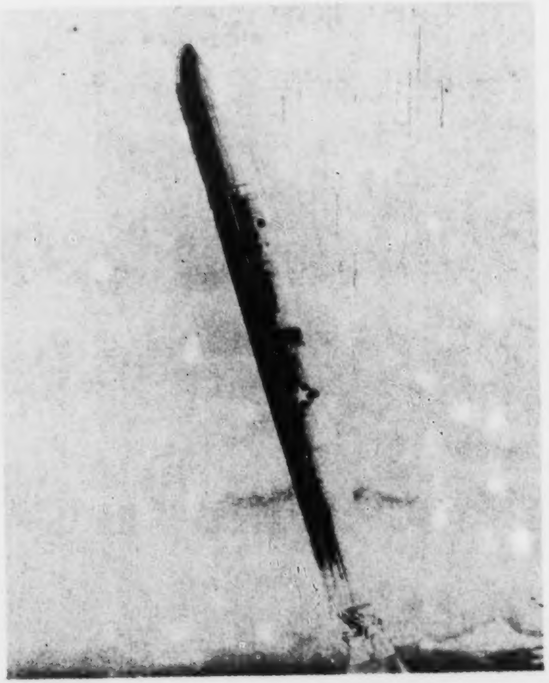
With respect to insurance, we certainly share the industry concern about how to best provide financial coverage for anticipated financial risks. To this end, the government should facilitate the rejuvenation of the launch and spacecraft insurance industry. The insurance industry, in concert with spacecraft manufacturers, spacecraft operators, and perhaps launch vehicle operators, should seek to design its own structure to bridge the present short-fall. Nonetheless, given the national need for space launch services the government should consider the prospect, at least until acceptable launch and satellite insurance rates have been re-established, of serving as the insurer of last resort if that becomes necessary.

In summary, the Titan launch vehicle series has been in production for almost thirty years. Each succeeding generation has incorporated technological improvements. The Titan family of contractors offer demonstrated stability and an established, on-going business with contracts running well into the 1990s. The Titan family of launch vehicles exists now. It meets the broad spectrum of user requirements and is a viable, proven candidate for a U. S. commercial space launch industry. That industry can be developed and sustained without government subsidy.

Competition should determine whether a commercial launch vehicle industry is viable. Competition for commercial payloads will benefit the government in launch vehicle prices for future government payloads. The budgetary burden on the taxpayer will be minimized by commercially funded ELVs for commercial payloads. Competitive pressures will assure both the lowest possible price and greatest technical efficiency. Although many have cited the short-term backlog and demand for launch vehicles, the long-term commercial ELV marketplace is not large. However, recent indications are that at least four launch vehicle manufacturers would probably compete for available payloads. All would probably not survive, but that risk--and the potential rewards of success--are the basic fabric of competitive enterprise.

Thank you. I look forward to answering your questions.

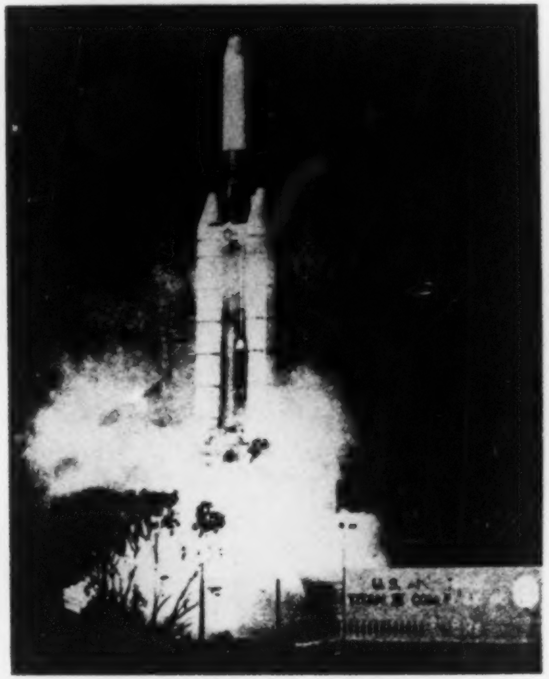
TITAN II LAUNCH VEHICLE



- UNDER CONTRACT FOR REFURBISHMENT OF EIGHT VEHICLES WITH AN OPTION FOR FIVE ADDITIONAL VEHICLES
- SMALL SPACECRAFT LAUNCH CAPABILITY TO LOW EARTH ORBIT
- DISCUSSING ADDITIONAL PROCUREMENT
- INITIAL LAUNCH CAPABILITY: APRIL 1988
- MAXIMUM PAYLOAD SIZE: 9.3' DIAMETER X 25' LENGTH
- LOW EARTH POLAR ORBIT: 4,200 LB

MARTIN MARIETTA

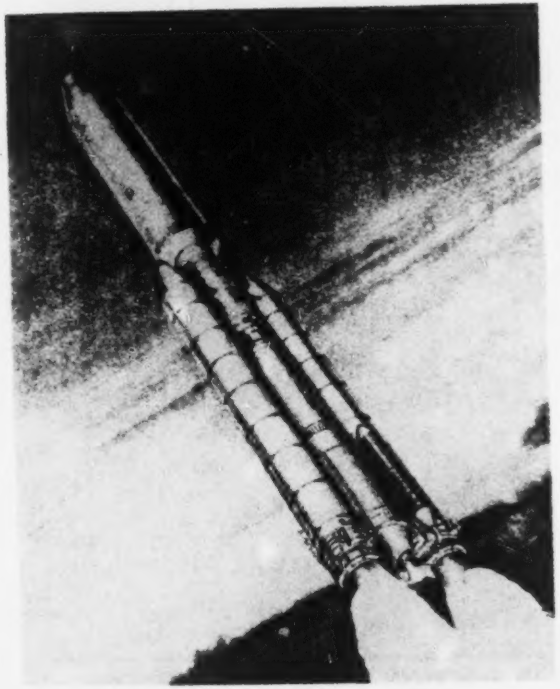
TITAN III LAUNCH VEHICLE - TITAN 34D



- SEVEN TITAN 34Ds IN AIR FORCE INVENTORY
- FLEXIBLE ALTERNATIVE FOR GOVERNMENT PAYLOADS
- MULTIPLE SPACECRAFT CAPABILITY
- COMMERCIAL LAUNCH VEHICLE ALTERNATIVE
- PAYLOAD SIZE: 9.3' DIAMETER x 47.1' LENGTH
- GEOSYNCHRONOUS ORBIT: 4,200 LB
- LOW EARTH POLAR ORBIT: 27,500 LB

MARTIN MARIETTA

TITAN IV LAUNCH VEHICLE

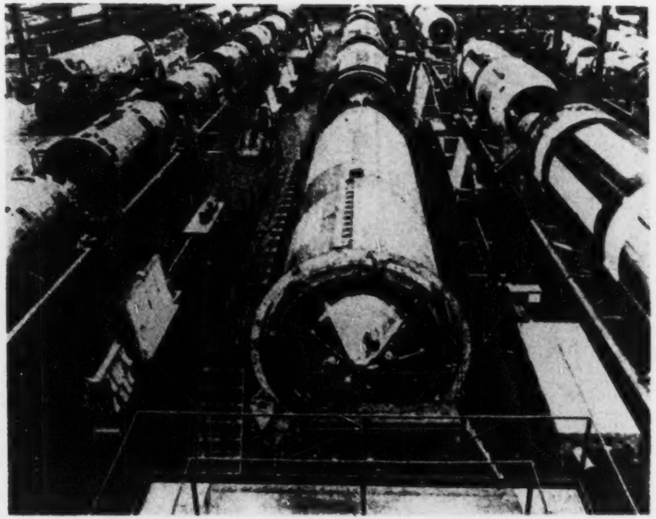


- UNDER CONTRACT TO DEVELOP AND BUILD TEN TITAN IVs. ADDITIONAL 13 APPROVED BY CONGRESS
- SHUTTLE EQUIVALENT PAYLOAD
- MULTIPLE PAYLOAD CAPABILITY
- INITIAL LAUNCH CAPABILITY: OCTOBER 1988
- MAXIMUM PAYLOAD SIZE: 15' DIAMETER x 40' LENGTH
- GEOSYNCHRONOUS ORBIT: 10,000 LB
- LOW EARTH POLAR ORBIT: 32,000 LB

MARTIN MARIETTA

MANUFACTURING CAPABILITY

HISTORICAL BUILD RATE FOR TITAN II ICBM = 20 / YEAR

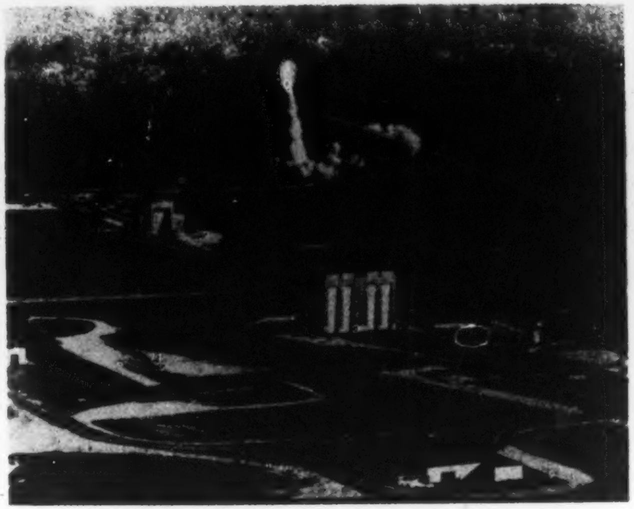


- CAPITAL INVESTMENT FOR TITAN PRODUCTION AND LAUNCH CAPABILITY LONG ESTABLISHED
- TITAN PRODUCTION RATE CONSIDERABLY LESS THAN CAPACITY FOR YEARS
- PLANNED USAGE -- CURRENT TITAN IV AND TITAN II CONTRACTS -- ONLY REQUIRES ONE-THIRD OF PRODUCTION CAPACITY
- EASILY ACCOMMODATE TITAN BUILD RATE = 14 / YEAR
- COST OF HIGHER PRODUCTION RATES MODEST: LIMITED TO ADDITIONAL RATE TOOLING, TEST EQUIPMENT AND HANDLING EQUIPMENT

MARTIN MARIETTA

LAUNCH COMPLEXES

TWO TITAN LAUNCH COMPLEXES ON EAST COAST -- TWO ON WEST COAST



- FOUR TITAN LAUNCH COMPLEXES EXIST -- THREE ACTIVE AND ONE UNDER MODIFICATION
- LAUNCH CAPABILITY EXCEEDS ANY PLANNED REQUIREMENTS
- MINOR IMPACTS FOR COMMERCIAL TITAN

MARTIN MARIETTA

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DENVER AEROSPACE
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MARTIN MARIETTA

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RICHARD E. BRACKEEN

Vice President, Space Launch Systems Division
Martin Marietta Denver Aerospace
Joined Corporation in 1967
Appointed to present position in 1985

Richard E. Brackeen is vice president of the space launch systems division at Martin Marietta Denver Aerospace.

He is responsible for all programs involving the Titan family of expendable launch vehicles, including launch operations at both Cape Canaveral, Florida, and Vandenberg Air Force Base (VAFB), California; upper stage programs such as the Transtage, transfer orbit stage, and orbital transfer vehicle; advanced launch vehicles; and U.S. Air Force space transportation system (STS) support programs, including the STS ground support systems program at VAFB and STS mission integration.

Prior to his current assignment, Brackeen was vice president for business development at Denver Aerospace, with responsibility for program development, marketing, and strategic planning.

Before relocating to Denver in 1982, Brackeen was vice president of strategic planning and development at the company's Aerospace Headquarters in Bethesda, Maryland. In that position, he was responsible for strategic planning, acquisitions, business development, and international operations.

Brackeen joined Martin Marietta in 1967 as a development program manager in the firm's Orlando operation and moved to Denver Aerospace in 1968. In 1969, he became project engineer for configuration and flight technology on Space Shuttle design. From 1972 to mid 1974, as director for both the Shuttle booster and X-24B programs, his responsibilities included development of the Shuttle solid rocket booster parachute recovery system and management of the rocket-powered X-24B flight research vehicle.

He also has served as director of business development for command and defense systems in Denver, and as director, advanced programs, at Aerospace Headquarters. Subsequently, Brackeen was executive director, and then president, of Martin Marietta International.

Brackeen was born January 10, 1939, at Oklahoma City, Oklahoma. He has an undergraduate degree in engineering from the University of Oklahoma, plus a masters degree in aerospace engineering from the University of Southern California and a masters degree in management from the Sloan School of Management, Massachusetts Institute of Technology, which he attended as a Sloan Fellow.

# # #

August 1986

Mr. NELSON. I apologize for the fact that we have another recorded vote. This has been happening all morning. But when you have the Department of Defense bill on the floor, you have to expect it. So I am going to recess, run over and vote, and come right back. Then we will hear from you, Mr. Rector. We will hear from everybody.

Keep in mind as we do our discussion, and as we get into the questions, yesterday, the representative from Hughes basically put forth the thesis that with existing vehicles, that an American ELV industry cannot be competitive with foreign competitors. So as we get on into the discussion, you, Mr. Brackeen, have said, obviously, that you disagree with that statement. You say that there will be a competitive industry and you've said that it will be one or two companies that will survive, offering a commercial ELV industry. I want to hear each of you address that directly.

What the gentleman from Hughes said yesterday was that you can't do it with the old vehicles, that you've got to—and, of course, he's proposing his own—and his thesis is that you've got to design a new vehicle that has cost in mind in order to be competitive with the Ariane and the Japanese vehicles in the 1990's. So let's keep that in mind as we get into the discussion. OK?

I will recess and I'll be back in just a few minutes.

[Recess.]

Mr. NELSON. All right, let's proceed.

Mr. Rector.

Mr. RECTOR. Thank you.

Mr. Chairman.

Mr. NELSON. Yes, sir.

Mr. RECTOR. We appreciate the invitation you extended to General Dynamics to be here today, and I personally appreciate being here once again before this subcommittee.

I'd like to pass along to you the regrets of Dr. Lovelace, who was unable to be here today. He's back at our corporate office on business—command performance—so he extends his regrets. But he also wanted me to commend you, Mr. Chairman, and your subcommittee, for your continued commitment to the U.S. preeminence in space. We think these hearings today are a part of that process.

I'd like to also echo the comments that were made earlier by Dick Brackeen about the importance of the AIAA workshop that your committee requested. I think it was the first time we all collectively got together in one room and were able to hear the other sides of the issues. So I commend you for sponsoring that meeting.

What I'd like to do is submit my written testimony for the records and summarize today.

The *Challenger* and the uncertainties associated with the timing of the return of the space shuttle fleet operations has created, we think, a significant amount of confusion in the commercial satellite industry. You heard some of that yesterday.

Commercial spacecraft owners and members of the launch vehicle industry have been waiting impatiently for clear, crisp decisions and establishment of a new Government policy appropriate to the changed world in which we find ourselves today.

As a matter of fact, we have already seen the impact by near-term decisions by some of these users to opt for the Ariane launches.

We applaud the action of this subcommittee in moving forward to solve a national problem and need. Your opening remarks yesterday, Mr. Chairman, showed recognition on your part of this need and some enthusiasm for moving forward.

I would like to offer some specific comments on the commercial launch policy and legislative initiatives that have been provided to us. But first I'd like to address the givens.

Your proposed policy appropriately states the U.S. space program must provide reliable access to space for all U.S. users. We agree with this need. However, meeting the diverse set of requirements for national security and defense missions, planetary and scientific missions, a manned space station, and commercial services and products from space dictates a multielement and robust solution.

That leads to the second given of the policy which states that a mixed fleet of the space shuttle and ELV's is required to assure reliable access to space. The DOD Titan IV, which you've heard about from Dick Brackeen, and the medium launch vehicle are positive actions and will help solve our critical current national needs.

In addition, a viable private sector ELV industry recommended by the President in May 1983, would provide a more focused and timely solution for a commercial satellite industry. These same commercial launch services could also be provided for certain Government missions.

The next given states that the U.S. Government should honor existing commitments to launch commercial payloads on the space shuttle. This to us doesn't seem like a given but rather a proposed action. These commitments are important to the future of the commercial satellite industry, both from an international and domestic standpoint. ELV's may help meet these commitments. We agree with the concept of the space shuttle remaining available to commercial users as a backup vehicle, which I will discuss later.

We fully support the given that America cannot concede the ELV launch service business to foreign competition. The Delta and the Atlas/Centaur ELV's provided reliable launches for the first 10 years of that now mature commercial satellite industry. The private sector in the United States will step up to the challenge of foreign competition in a manner similar to what has occurred in the commercial aircraft industry.

The final given of the subcommittee aptly states that the private sector has, to date, not developed a commercial industry. It further states that some Government steps must be taken to provide a climate in which the U.S. commercial ELV's can be competitive.

We agree with both statements and feel that positive action has been taken by the Government and progress made. The Presidential policy of 1983 I referred to earlier, the congressional Commercial Space Launch Act of 1984, and the designation of the Department of Transportation as the Government agency for implementing this policy, are positive actions and progress has been made.

Having the agreements, we have been constructing and negotiating with both NASA and the Air Force for the last 2 years, approved are essential to us and an essential ingredient of a viable ELV industry. This was aptly discussed yesterday with Dr. Fletcher.

I would like to address now the five specific items the subcommittee is considering for inclusion in a bill to have a successful, viable, commercial ELV industry.

First, the proposed NASA purchase of 15 additional launches addresses only the Delta class vehicle Government payloads. Our assessment of the market indicates there are fewer than 15 payloads of this class over the 5-year period proposed.

There are a number of other payloads in the NASA plans that exceed this performance requirement, including GOES, and many scientific and planetary spacecraft. A bill that is limited to only the lower requirement performance range would be seen as a Delta procurement bill, not a commercial space launch policy bill.

I think Dr. Fletcher in his testimony stated yesterday that this proposed legislation was too restrictive, and we agree.

One approach may be to procure an economical quantity of each existing ELV for which the Government has planned or projected missions through, let's say, the 1995 time period and that are within the capability of that respective ELV. Such procurements would ensure that the diverse industrial base which is required for a robust launch vehicle fleet and assured access to space.

Two. We agree that the Government should provide access to launch facilities for commercial launches on an additive cost basis. We agree with that concept.

Three. Making sure that the Government does not unfairly compete with private industry by setting the price of a space shuttle launch at not less than the price for a comparable U.S. ELV launch appears to be unworkable. Under this mode, NASA would continue to control this Nation's launch business and no commercial industry would be established.

A commercial ELV industry in a free enterprise environment would naturally create competition among the various suppliers. There will be a variety of business arrangements with customers. Prices will be adjusted as considered prudent to make sales and reasonable earnings. The commercial industry would be at a disadvantage since NASA may still be able to offer special considerations and attractive funding arrangements.

As an alternative, commercial ELV's should be the primary transportation for commercial satellites, but perhaps the space shuttle, as I mentioned earlier, could serve as a backup. The price would be the same as for the ELV.

This concept has some problems but offers an advantage of holding out the promise to the spacecraft owner that a backup may be available. This was discussed at the AIAA workshop. Thus, a U.S. ELV will look more attractive than a foreign ELV. Most importantly, it takes NASA out of the role of being a competitor with the commercial ELV industry.

Mr. Nelson. You are saying it would look more attractive because it has the backup of the shuttle?

Mr. Rector. Yes; if, for example, one of the ELV systems had a problem and was down for a certain amount of time, there would be an alternate solution available on space available on the space shuttle, and they would not have to start looking to a foreign provider of those launch services. They would know that the United States would have a capability of handling it.

Mr. Nelson. Is that attractiveness still there even though to get your upper stage may cause a year and a half delay before you could—you've got to manufacture that PAM upper stage or whatever upper ~~stage~~ you are using—that's going to take you a year and a half. Is that attractiveness still there even though that's the backup?

Mr. Rector. I think so, because they would then still be looking for an alternate solution and integrating on a foreign launch vehicle would have the same problem in the length of time.

Mr. Nelson. OK. Now, I want to make sure I understood what you said originally. I thought you said that you disagreed with the initiative that we were suggesting, which was that the price of the shuttle would have to be at least higher than the price of the ELV. But then I thought I heard you say the opposite.

Mr. Rector. No; I said if NASA was still able to provide rides for commercial payloads at an equivalent price to an ELV, that means they're still in the competition.

Mr. Nelson. OK, right.

Mr. Rector. That's the point.

Mr. Nelson. That's not what we're intending. We're intending the opposite. We're even going so far as to say that as an incentive or a disincentive to NASA, that anything over and above whatever is the stated price, that if there was any kind of rebate it wouldn't come back to NASA, it would go back to the U.S. Treasury. And that we would set, as a policy, that you fly on the ELV's, Mr. commercial satellite, but that the policy wouldn't say that you're absolutely prohibited from the shuttle, which would leave open this backup capability.

Mr. Rector. If there's still that option of the user to go for the shuttle versus an ELV, we think that's going to be difficult in terms of really being competitive, knowing that this option still exists. There is some attractiveness sometimes to flying on the shuttle. That's what we think would be a disadvantage.

Mr. Nelson. So what you're saying is, ban commercial satellites from the shuttle.

Mr. Rector. In general; yes.

Mr. Nelson. OK. Let's just get very clear what you're saying.

Mr. Rector. And I'll come back to that and that's exactly what I'll say later. That's true.

There are some exceptions that were discussed yesterday.

Mr. Nelson. But you would still, having said banned commercial satellites from the shuttle, you're still saying you would like in your back pocket a ticket on the shuttle in case something happened to your ELV's?

Mr. Rector. Yes; and I think that's similar to the situation we're in today in that many of the existing ELV's are not readily available today as an alternate to the shuttle because that was not an option, not even a backup option, to the users. So they've designed themselves, in many cases, off of today's U.S. ELV's to the other option which is Ariane. So that is a problem. Some of them have designed themselves even off the Ariane, such as a wider diameter. So what I think would be important is to know they would have that option in case of a problem with the ELV, to go to the shuttle. They would most likely design that spacecraft to be compatible for that.

Mr. NELSON. OK. Please, why don't you start summarizing your comments now and——

Mr. RECTOR. I'm almost done. I'd like to continue with the other two points.

Mr. NELSON. Sure.

Mr. RECTOR. The fourth point, which is to discourage NASA from active pursuit of commercial customers will have a result believed to be contrary to the stated aims of the subcommittee. The wording leaves an important aspect of the policy to the discretion of NASA. A policy aimed at establishing a viable commercial ELV industry would prohibit NASA from competing, not just discourage.

No. 5. Although insurance availablility and cost is a major problem, this seems a minor contribution to the solution. The private insurance industry would establish appropriate collective coverage without encouragement from Congress. An immediate impact on the insurance situation could be achieved by risk sharing by the vehicle and spacecraft manufacturers. We are exploring that subject at the present time.

Those are my specific comments on your policy and proposed legislation.

I would like to conclude with a brief summary of what General Dynamics' position is regarding the commercial ELV business. We've made these points in previous testimonies. There are three major conditions that are needed:

First, a clear and consistent policy—no Government competition with the commercial launch vehicle service suppliers.

Second, the use of existing Government capabilities and facilities on an additive cost basis, and

Third, an aggregated business base of sufficient size and appropriate timing to allow for competitive pricing and appropriate cash-flow.

Mr. NELSON. Now, what does that last statement mean?

Mr. RECTOR. Well, I'll get to that right now.

Mr. NELSON. State it again. I want to make sure I heard it right.

Mr. RECTOR. OK. An aggregated business base of sufficient size and appropriate timing to allow for competitive pricing and appropriate cash-flow.

Let me explain what that means. Typically, the commercial aircraft business today does not start a new airplane, like a Boeing 7X7, until they have an adequate customer base to warrant that investment. We would not want to start up this program if we only knew we were going to sell two more Atlas/Centaurs, because there's quite an investment to start that line up again even though it's an existing vehicle. Many of our vendors are not building parts, and the startup costs do amount to some money.

So if we only had an order for two, we would probably not restart our line. So an aggregated business base of some amount of vehicles, which has been discussed by our corporate office, is required.

Mr. NELSON. But you would have that aggregated business base, then, under your definition——

Mr. RECTOR. Well, we would——

Mr. NELSON. Wait, wait, wait.

Mr. RECTOR. Excuse me.

Mr. NELSON [continuing]. If you were the winner of an RFP by NASA or the Air Force.

Mr. RECTOR. That would absolutely——

Mr. NELSON. Is that correct?

Mr. RECTOR. That's correct.

Mr. NELSON. Well, I mean, we're making that assumption. We're making that assumption that—that—that NASA is going to acquire ELV's for purposes of working off the backlog of Government payloads and also Pete Aldridge is doing the same thing.

Mr. RECTOR. That's right, but the timing of both those actions is not adequate for the things you heard from the users yesterday who have been asking us for specific prices and schedules for launches now, not 6 months from now, as to when they could begin getting their assets up. So we have to be in a position today to respond to them—not until the ELV competition is done, which is expected next winter.

Mr. NELSON. Well, how can you do that?

Mr. RECTOR. By aggregating enough of those commercial users to say now that's a viable business and it makes sense to start the line up again. That's what we mean by an aggregated business base. It can be Government plus commercial, or commercial. But there's got to be at least a reasonable number of orders before we'll start that line up. That's what that means.

Mr. NELSON. What—what is going to cause all of the commercial users to come knocking on your door, and not on his door, and not on his door?

Mr. RECTOR. I think the size of the vehicle and the terms and conditions we individually offer them. They'll make their selection based upon the thing that's most attractive for their business venture.

Mr. NELSON. Do you see any evidence that this in fact is starting to occur?

Mr. RECTOR. Yes; we have received specific requests from these users.

Mr. NELSON. Enough to give you the adequate business base?

Mr. RECTOR. That's correct. If our price is attractive to them. Basically what all of us have is a problem right now. How quickly can we provide them a launch. That, I think, is a common problem amongst all three of the current launch vehicles. Our lines are basically down and it would take up to 2 to 3 years to get back to where we could provide vehicles. We can't provide them a launch tomorrow, or within 1 year, or within 2 years. Generally speaking, we're talking 1989.

So that's the problem. They would like to fly in 1988, some of them. We just can't do it. At least we cannot.

Mr. NELSON. Are you saying underlying all of that, that you want to see the Government, the U.S. Government, to break its contracts to launch so that those customers will come and launch on yours?

Mr. **Rector**. I didn't really say that, because that isn't what I really said. But there are some of them that——

Mr. **Nelson**. Does that have to occur in order for you to be in business?

Mr. **Rector**. It depends. Not all of them are making progress payments. Some have just made down payments for either a position on Ariane or shuttle. They're still waiting to know what really the U.S. position is going to be, whether they will fly, what time they will fly, and then what the price would be. So that's the decisions that they need——

Mr. **Nelson**. All right, now I want——

Mr. **Rector** [continuing]. Before they can make their decision whether, gee, that's not an adequate solution for me and I should move over to the ELV. That's the confusion I referred to early.

Mr. **Nelson**. I understand that but I want to ask the question again.

The question is: Where there are launch commitments and—well, let's don't even talk about commitments, let's talk about contracts. Where there is earnest money deposited, and there's a contract to launch—in order for you to be successful, do those customers have to leave those contracts with NASA and come to you for you to have that business base that you're talking about?

Mr. **Rector**. I think if we are to accomplish flying the backlog off that Dr. Fletcher referred to yesterday when he mentioned 50 to 60 vehicles that they could not accommodate until the mid-1990's. We can certainly do that at an earlier date. Some of those are on an existing manifest and therefore, they would have to option to break their own contract and go over to the ELV.

Mr. **Nelson**. Well, was that answer yes or no?

Mr. **Rector**. It's an option up to the users. But they need that policy decision that we have been talking about, when am I going to fly on the shuttle.

Mr. **Nelson**. All right. Let me—I'm going to call on you but I want to make sure I understand. Just 1 second and I'll get to you, Mr. Walker.

In this valued free enterprise market, if you're offering a superior product, cannot those customers walk away from the shuttle anyway?

Mr. **Rector**. Sure.

Mr. **Nelson**. All right. Are you going to offer a superior product; is that what you intend to do?

Mr. **Rector**. We think we have a product adequate to meet their needs.

Mr. **Nelson**. Less than what it would cost them to go on shuttle?

Mr. **Rector**. No.

Mr. **Nelson**. But——

Mr. **Rector**. At the current pricing policy that we understand. That is exactly why we do not have a viable industry today. We are not cost competitive.

Mr. **Nelson**. OK. So you're going to get those customers because now after the disaster, they have to wait too long?

Mr. **Rector**. That's one of the reasons.

Mr. **Nelson**. And when could you first launch?

Mr. **Rector**. 1989.

Mr. **Nelson**. All right, Mr. Walker.

Mr. **Walker**. Well, I just wanted to follow on—on the line of questioning. It—it substantially helps you at that point—I assume all of you—if we were to revise that pricing policy and go to a transparent policy, too. I mean, that—that—that makes a big difference in—in your ability then to be attractive to those customers as well; is that right?

Mr. **Rector**. It does, but the marketplace is not that large that there's going, as Dick Brackeen said, there's going to be enough market there for all of us to survive, and especially if we are just working off the backlog problem, knowing that once again we might be in the position we are right now, which is competing with the shuttle.

Mr. **Walker**. Well, let me—let me ask you what—what you think would happen if we do the reverse of what the chairman was talking about, or not the reverse, but to accomplish the same result. What if NASA were to announce, or we were to announce as a policy that NASA was—was basically throwing out all the contracts that they had signed. What would be the impact on your industry?

Mr. **Rector**. I think that would make a significant impact on us, and give us, a fair chance to compete for those payloads.

Mr. **Walker**. So, in other words, if—if these people were released from all their contracts, by whatever mechanism, that would—that would indeed provide the business base that you were talking about?

Mr. **Rector**. Yes.

Mr. **Walker**. Well, that, I mean—I think that ultimately gives us an answer, then, if in fact—if in fact those contracts were released, you know, even as a matter of policy here, that it would change the—it would change the climate in—in which they—they compete.

I had another question for you, too, Mr. Rector.

I raised yesterday at the hearings with Mr. Fletcher, the question of the contract for commercialization that—that you all have signed and NASA has not. The first question is: Do you think you need that signed in order to commercialize your vehicle?

Mr. **Rector**. I think by law it has to be signed. By law, that has to be done.

Mr. **Walker**. OK.

Mr. **Rector**. That's a requirement for NASA to let us fly Atlas-Centaur——

Mr. **Walker**. So it really—it really is a detriment to you not to have that—that going ahead and—and you have some problems firming up your plans until NASA has made that commitment firm by signing that document; is that correct?

Mr. **Rector**. Yes; we think even the users would want to know whether we have an agreement with the Government, we can do what we say we can do, which is to go ahead with the program.

Mr. **Walker**. And that agreement was signed by you, as I understand it, sometime last year; is that correct?

Mr. **Rector**. Yes, last November.

Mr. **Walker**. Last November. So essentially it's been sitting now for the better part of three-quarters of a year without half a year or better—almost three-quarters of a year—without NASA having signed in—into that policy.

Mr. **Rector**. That's correct.

Mr. **Walker**. What do you think—well, that's not a good way of asking it.

Do you have any indication why you have run into a roadblock after—after going ahead and negotiating? I mean, has NASA appeared to you to be unwilling to move in the—in the direction of—of—of commercialization in—in their negotiations, or do you think it's largely just a matter that—that they're waiting for policy to be set?

Mr. **Rector**. Well, that's what Dr. Fletcher said yesterday. Of course, the policy discussions have been since January 28, and that was signed off in November.

We're not sure what the hesitation is about moving forward. It definitely is a requirement before we can. We were asked originally in 1981 by NASA to consider commercializing the Atlas/Centaur. So we were encouraged to start this whole process by NASA, and we in good faith proceeded along that path and spent 2 years negotiating this agreement. And we really don't understand why it hasn't been signed. But it must come to you for approval.

Mr. **Walker**. I've got to tell you, I don't understand either.

Mr. Dealy, you're in somewhat the same circumstances, aren't you?

Mr. **Dealy**. That's correct. I have not yet given my statement——

Mr. **Walker**. Oh, I'm sorry. OK.

Mr. **Nelson**. I was jumping in here trying to clarify Mr. Rector's. We still need to hear from Mr. Ordahl, Dealy, and Koopman. So let's go ahead with you, Mr. Ordahl.

[The prepared statement of Mr. Rector follows:]

STATEMENT OF GENERAL DYNAMICS

TO THE SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS
COMMITTEE ON SCIENCE AND TECHNOLOGY
U. S. HOUSE OF REPRESENTATIVES

BY

WILLIAM F. RECTOR, III
VICE PRESIDENT, PROGRAM DEVELOPMENT
GENERAL DYNAMICS
SPACE SYSTEMS DIVISION

14 AUGUST 1986

Mr. Chairman, we appreciate the invitation you extended to General Dynamics to appear before your Subcommittee today. Unavoidably, Dr. Alan Lovelace could not be here at this time and has asked me to represent the General Dynamics Space Systems Division.

Dr. Lovelace requested that I express his regrets and to commend you, Mr. Chairman, and your Subcommittee for your continued commitment to United States pre-eminence in Space. That commitment is critical in times such as these, and the subject of your hearing today is very important.

The Challenger accident and the uncertainties associated with the timing of the return of Space Shuttle fleet operations has created a significant amount of confusion in the commercial satellite industry. There has been much discussion and debate over the contents of our future space transportation policy. Commercial spacecraft owners and members of the launch vehicle industry have been waiting impatiently for clear, crisp decisions and establishment of a new Government policy appropriate to the changed world in which we find ourselves. We fully recognize how difficult it is to arrive at the best solution with so many competing factors to consider. We applaud the action of this Subcommittee in moving forward to solve a national problem and need.

I would like to offer our comments on the specific Commercial Space Launch Policy and potential legislative initiative provided to us which your Subcommittee is considering during these hearings.

GIVENS

As your proposed policy appropriately states, the Governmental and industrial U.S. Space program must provide reliable access to Space for all U.S. users, including manned use. We agree with this need. However, the means of meeting the diverse set of requirements ranging from the priorities of national security and defense missions, to critical launch windows of planetary and scientific missions, to the goal of achieving a permanent manned presence in Space, to the many practical business aspects of providing commercial services and products from Space dictates a multi-element and robust solution.

This leads directly to and supports the second "given" of the policy which states that a mixed fleet of the Space Shuttle and expendable launch vehicles (ELVs) is required to assure reliable access to Space. We fully agree with this. The actions of the Department of Defense in proceeding with both the complementary expendable launch vehicle (CELV) - now called Titan IV - and the medium launch vehicle (MLV) are positive and will help solve our critical current national needs.

The national policy issued by the President on 16 May 1983 encouraged the establishment of a commercial ELV industry. We believe there are certain ELVs that are mature and reliable and could form a basis for such an industry. A viable, private sector ELV industry would provide a more focused and timely solution for the mature and expanding commercial satellite industry. These same commercial launch services could also be provided for certain Government missions.

The next "given" states that the U.S. Government should honor existing commitments to launch commercial payloads on the Space Shuttle. This does not seem to be a given but rather a proposed action. How or to what degree the Government honors these commitments may be important to the future of the commercial satellite industry both internationally and domestically. Providing the appropriate ELV on an interim basis may help meet these commitments. We agree with the concept of the Space Shuttle remaining available to commercial users as a back-up vehicle as I will discuss later.

We fully support the "given" that America cannot concede the ELV launch service business to foreign competition. The U.S.-built Delta and Atlas/Centaur ELVs were very instrumental in providing reliable launches during the first ten years of the successful commercial satellite industry. The private sector in the U.S. will step up to the challenge of foreign competition in a manner similar to what has been accomplished in the commercial aircraft industry.

The final "given" of the Subcommittee aptly states that the private sector has, to date, not developed a commercial industry. It further states that some Government steps must be taken to provide a climate in which U.S. Commercial ELVs can be competitive.

We agree with both statements and feel that positive action has been taken by the Government and progress made. The previously mentioned Presidential policy of 1983 on establishing a commercial ELV industry, the Congressional Commercial Space Launch Act of 1984, and the designation of the Department of Transportation as the Government agency for implementing the overall commercial space transportation policy are examples of this positive action and progress. The remaining portion of my testimony will address this issue and the five specific items the Subcommittee is considering for inclusion in a bill.

COMMENTS ON THE FIVE PROPOSED INCLUSIONS IN A BILL TO ESTABLISH POLICY DIRECTION

1. The proposed NASA purchase of 15 additional launches addresses only the Delta launch vehicle class Government payloads. Our assessment of the market indicates there are fewer than 15 payloads of this class over the five-year period proposed. There are a number of other payloads in the near-term NASA plans that exceed this performance requirement including GOES-I, J, K, L, and M, ACTS, ROSAT, COBE, CRRES, UARS, MSAT, SOHO, Mars Observer, Galileo, Ulysses and Magellan. A bill that

limited its direction to only the lower performance range would be seen as a Delta procurement bill, not a commercial space launch policy bill.

An approach that might help solve our national launch vehicle crisis is to procure an economical quantity of each existing ELV for which the Government has planned or projected missions through 1995 that are within the performance capability of that ELV. This would most likely result in procurements of Delta, Atlas/Centaur, Titan IV and possibly Titan 34D and Scout. Such procurements would ensure the diverse industrial base which is required for a robust launch vehicle fleet and assured access to Space.

2. We agree that the Government should provide access to launch facilities for commercial launches on an additive cost basis.

3. Making sure that the Government does not unfairly compete with private industry by setting the price of a Space Shuttle launch at "not less than the price for a comparable U.S. ELV launch" appears to be unworkable unless ELVs are purchased by NASA for commercial users as was done in the past. In such cases the price to the user would be the same regardless of the type of launch vehicle used. Under this mode, NASA would continue to control this nation's launch business and no commercial industry would get established.

   A commercial ELV industry in a free enterprise environment would naturally create competition among the various suppliers. There will not be a standard price for each commercial ELV which would set the Space Shuttle price. There will be a variety of business arrangements with customers. Prices will be adjusted as considered prudent to make sales and reasonable earnings. Even if a way could be found to make Space Shuttle prices equal in each case, the commercial industry would be at a disadvantage since NASA may still be able to offer flights of payload specialists and other prestige considerations, as well as attractive funding arrangements.

As an alternative, commercial ELVs should be the primary transportation for commercial satellites, but perhaps the Space Shuttle could serve as a back-up. If any given ELV has a long stand-down period for some reason, the spacecraft awaiting launch may be shifted to the Space Shuttle for launch on a space-available basis. The price would be the same as for the ELV. This concept has difficult problems related to timing of the decision to shift from one vehicle to the other, and to integration of the spacecraft with the Space Shuttle. However, it offers the advantage of holding out the promise to the spacecraft owner that a back-up may be available. Thus a U.S. ELV will look more attractive than a foreign ELV. Most importantly, it takes NASA out of the role of being a competitor with the commercial ELV industry.

4. This effort to "discourage" NASA from active pursuit of commercial customers will have a result believed to be contrary to the stated aims of the Subcommittee. The wording leaves an important aspect of the policy to the discretion of NASA. A policy aimed at establishing a viable commercial ELV industry would prohibit NASA from competing, not just discourage.

5. Although insurance availability and cost is a major problem, this seems a minor contribution to the solution. The private insurance industry would establish an "Underwriters Laboratory" without encouragement from Congress if that need is perceived. Perhaps the Government could provide a flight certification capability such as the FAA provides for the commercial aircraft industry to maximize mission success and reliability. An immediate impact on the insurance situation could be achieved by significant risk sharing by the vehicle

and spacecraft manufacturers. This is a subject we are exploring.

Those are my specific comments on your policy and proposed legislation, Mr. Chairman.

I would like to conclude by briefly summarizing the General Dynamics position regarding the commercial ELV business. There are three major conditions that are needed:

1. A clear and consistent policy - no Government competition with the U.S. commercial launch vehicle service suppliers.
2. The use of existing Government capabilities and facilities on an additive cost basis.
3. An aggregated business base of sufficient size and appropriate timing to allow for competitive pricing and appropriate cash flow.

If the first two conditions become a reality, we will be working energetically to establish an aggregated business base to supply services to the Government or to the private sector.

The United States Government is at a very important crossroad regarding our national space transportation plans and policies. It is obvious that there is a need for a viable United States commercial ELV industry, and General Dynamics stands ready to support our Government in obtaining that goal.

On behalf of the General Dynamics Corporation, I again wish to express my appreciation for having had the opportunity to address this Subcommittee and present our perspective on these critical issues.

Mr. **Ordahl**. OK. Mr. Chairman and members of——

Mr. **Nelson**. Hold on. I think I just heard it. No? I thought I heard the bells start to buzz. OK. Pretty soon you get paranoid up here.

Mr. **Ordahl**. Mr. Chairman, members of the subcommittee: Again I would like to thank you for this opportunity to represent McDonnell Douglas.

I also participated in the recent ELV workshop and greatly benefited from that interchange and can only echo the comments made by Mr. Rector and Mr. Brackeen on that subject, and compliment and thank you for fostering that meeting.

During this period of launch vehicle policy realignment, we believe that the United States should use all of its available launch system assets in the most direct yet balanced way to reestablish our launch capacity and capability at the earliest possible time for all users of our launch systems, while still developing longer term policies which would foster increased commercial investments.

At this recent workshop, there appeared to be universal agreement that the Nation could no longer depend upon a single launch system. The conclusion was that the highest priority should be given to a mixed fleet, using both the shuttles and the ELV's.

However, as you stated in your invitation letter, private companies really have not yet developed a commercial ELV industry. And our last subcommittee testimony presented some reasons why McDonnell Douglas, after a decade of the ELV and upper stage commercial experience, has not yet entered into the international ELV launch services competitive arena on a commercial basis.

And a summary of these reasons boil down basically to the high risks, as we viewed them, that a truly commercial organization has to assume when competing against government support organizations—and Arianespace, of course, is a good example of that.

Some of these risks are such things as: Large production startup costs; continuing uprating investments to remain competitive; the unavailability of insurance or certainly high insurance costs; reserves for failures, if you should experience that adversity; and foreign competitors flexibility on pricing and financing.

And I might dwell here just for a moment to say that we see that as a key issue, because it is a very unpredictable thing. These national programs that we are competing—or would be competing against, such as Arianespace, the Chinese, possibly the Japanese, are in fact government subsidized systems, and their pricing policies are not predictable in advance. And we have had experience with that in which we have on our—Delta PAM system, lost repeat business, which we should have had because it was strictly the relaunch of the same kind of satellite that had previously been launched. We lost repeat business because of price-cutting on the part of our competitor—in that case, Ariane.

The ultimate success of commercial ventures in this area will depend upon various numerous variables, and they're very difficult to predict.

But our experience thus far is these—the risks of these undertakings must be considered quite high, and that prudent businessmen will be cautious.

We believe that the subcommittee is proceeding in a proper direction to allay many of these risks. However, we have concerns—that these new risk-reducing legislative policies, along with the administrative implementation, will take considerable time. And our fear is that in the meantime many, if not all, of the commercial launch service users would be forced to seek alternatives outside the United States.

We at McDonnell Douglas continue to recommend a government-sponsored mixed fleet approach to be taken to provide a predictable capability as soon as possible, with this fleet consisting of both the shuttles and the ELV's that would perform missions for all of the customers, both government and commercial.

Maximum flexibility would be maintained to assign missions to either the ELV's or the shuttle and commercial customers would pay the same price independent of the launch vehicle assignment.

A government-supported mixed fleet is quickly obtainable by extending existing ELV contracts.

This approach would provide renewed U.S. launch capability at the earliest possible date and assure the users of a firm U.S. commitment. It could also provide a transition period for the Government, in conjunction with industry, to provide improved climate—in which any commercial ELV can be truly competitive.

It is also our continued recommendation that any new policies in this area should not preclude the use of the shuttle for commercial missions, including the launches of communications satellites.

In the late 1970's, McDonnell Douglas made two major business decisions based upon the then U.S. policy to utilize the space shuttle for commercial missions. The first decision was to commercially develop the payload assist module upper stage family primarily used for launching communications satellites from the shuttle. And prior to the shuttle tragedy, it appeared that the PAM Program would eventually return a profit on that investment.

However, if commercial satellite launches are no longer allowed from the shuttle, our opportunity for a positive return on that investment is virtually eliminated.

The second decision was to develop the electrophoresis operations in space, which provides for the manufacturing of various pharmaceuticals in the zero-G gravity environment provided by the shuttle. Without access to the shuttle itself, of course, the opportunity to continue our research efforts in that area would be deleted.

Therefore, again, the elimination of commercial missions from the shuttle has a significant adverse impact on current and downstream business opportunities for McDonnell Douglas and, we believe, could have similar effects on other elements of the space industry.

With these comments as background, let me more specifically comment on several portions of the proposed bill.

First, with regards to the proposed procurement of 15 launches, we believe that the initial production should be undertaken as soon as possible as a part of this government-sponsored mixed fleet for both government and commercial missions to meet the near-term built-up launch demand. Additional continuing ELV launch procurement for government missions would then be an important next step beyond the government-sponsored mixed fleet to provide a base for commercial production.

However, the production base of our principal competitor, Ariane space, is approximately eight vehicles a year. And with this base and the strong European community support, Ariane has been highly competitive in the world launch services market with prices that have been several million dollars below the prevailing market set by the shuttle.

This could be partially overcome, we believe, by allowing U.S. companies to sell on the world market on the basis of incremental additive cost. That—the price of a commercial vehicle under this arrangement would be set on the basis of actual additional costs incurred for the vehicle over and above the government program cost. This could satisfy the commercial users but would also help to strengthen the national program.

I think that legislation would be required to allow this special cost allocation procedure.

With regards to shuttle pricing, the price of the launch vehicle services must—must ultimately recognize and adjust to the worldwide competitive environment.

Assuming a Government-sponsored mixed fleet is funded initially, the same price for equivalent launch services should be charged independent of the launch vehicle and continued equivalent pricing is necessary to foster a commercial ELV industry. We agree, and believe that special incentives for the research use of the shuttle through such things as the Joint Endeavor Agreement Program should be continued.

In summary, the goal of stimulating a reconstitution of our launch vehicle capacity is extremely important. The accompanying governmental legislative/administrative changes will require considerable time to implement. To maintain the U.S. lead in space during this period and to assure our present customers are not lost forever to foreign sources, a Government-supported mixed fleet is recommended as the immediate approach—with transition can then be accomplished in an orderly manner to include an ELV industry, prepared with minimum Government involvement, to compete on the world launch service market.

Thank you.

[The statement of Mr. Ordahl follows:]

COMMERCIAL EXPENDABLE LAUNCH VEHICLE DEVELOPMENT LEGISLATION

STATEMENT BEFORE U.S. HOUSE OF REPRESENTATIVES SUBCOMMITTEE
ON SPACE SCIENCE AND APPLICATIONS

BY

CHARLES A. ORDAHL

VICE PRESIDENT, ENGINEERING AND OPERATIONS

MCDONNELL DOUGLAS ASTRONAUTICS COMPANY
HUNTINGTON BEACH, CALIFORNIA

14 AUGUST 1986

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE:
THANK YOU FOR THE OPPORTUNITY TO REPRESENT MCDONNELL DOUGLAS IN ADDRESSING POSSIBLE LEGISLATIVE ACTION WHICH WILL STIMULATE THE DEVELOPMENT OF A COMMERCIAL EXPENDABLE LAUNCH VEHICLE INDUSTRY. WE CONCUR THAT, ONCE ESTABLISHED, SUCH AN INDUSTRY WOULD BE AN IMPORTANT ELEMENT IN PROVIDING RELIABLE ACCESS TO SPACE IN THE UNITED STATES.

DURING THIS PERIOD OF LAUNCH VEHICLE POLICY REALIGNMENT WE BELIEVE THAT THE UNITED STATES SHOULD USE ALL OF ITS AVAILABLE LAUNCH SYSTEM ASSETS IN THE MOST DIRECT YET BALANCED MANNER TO REESTABLISH LAUNCH CAPABILITY AT THE EARLIEST POSSIBLE TIME FOR ALL OF THE USERS OF OUR LAUNCH SYSTEMS. SINCE THESE ASSETS, INCLUDING BOTH THE MAJOR ELV'S AND THE SHUTTLE, ALL BELONG TO THE UNITED STATES, IT IS IMPERATIVE THAT THE UNITED STATES GOVERNMENT UNDERTAKE STRONG POSITIVE RECOVERY ACTIONS IN THE NEAR TERM, WHILE DEVELOPING LONGER TERM POLICIES WHICH WILL FOSTER INCREASED COMMERCIAL INVESTMENTS.

AT THE RECENT AIAA EXPENDABLE LAUNCH VEHICLE WORKSHOP REQUESTED BY CHAIRMAN DON FUQUA WHICH I ATTENDED FOR MCDONNELL DOUGLAS, THERE WAS A WIDE RANGE OF OPINIONS ON SOLUTIONS TO OUR LAUNCH VEHICLE DILEMMA. THERE, HOWEVER, APPEARED TO BE UNIVERSAL AGREEMENT THAT THE NATION COULD NO LONGER DEPEND ON A SINGLE LAUNCH VEHICLE SYSTEM. THE CONCLUSION WAS THAT THE HIGHEST NATIONAL PRIORITY SHOULD BE GIVEN TO RECONSTITUTING THE UNITED STATES LAUNCH CAPABILITY WITH A MIXED FLEET OF SHUTTLES AND ELV'S. NO OTHER COUNTRY CAN PROVIDE A COMBINED REUSABLE/EXPENDABLE FLEET WHICH WOULD GIVE COMPARABLE ASSURANCE OF ACCESS TO SPACE. COMMERCIAL INDUSTRY IS CONSIDERED AN IMPORTANT FUTURE OUTGROWTH OF THIS MIXED FLEET APPROACH.

HOWEVER, AS YOU HAVE STATED IN YOUR INVITATION LETTER, PRIVATE COMPANIES HAVE NOT DEVELOPED A COMMERCIAL ELV INDUSTRY. OUR LAST SUBCOMMITTEE TESTIMONY PRESENTED THE REASONS WHY MDAC, AFTER OVER A DECADE OF ELV AND UPPER STAGE COMMERICAL EXPERIENCE, HAS NOT ENTERED THE INTERNATIONAL ELV LAUNCH SERVICES COMPETITIVE ARENA ON A COMMERCIAL BASIS. A SUMMARY OF THESE REASONS "BOIL DOWN" TO THE HIGH RISKS A TRULY COMMERCIAL ORGANIZATION HAS TO ASSUME WHEN COMPETING AGAINST GOVERNMENT SUPPORTED ORGANIZATIONS SUCH AS ARIANESPACE. BRIEFLY STATED THESE RISKS ARE:

- o LARGE PRODUCTION START-UP COSTS
- o CONTINUING UPRATING INVESTMENT TO REMAIN COMPETITIVE
- o UNAVAILABLE INSURANCE OR EXTREMELY HIGH INSURANCE COSTS
- o RESERVES FOR FAILURES
- o FOREIGN COMPETITORS FLEXIBILITY ON PRICING/FINANCING
- o GOVERNMENT POLICY SHIFTS

THE ULTIMATE SUCCESS OF COMMERCIAL VENTURES IN THIS AREA WILL DEPEND ON NUMEROUS VARIABLES WHICH ARE VERY DIFFICULT TO PREDICT. OUR EXPERIENCE THUS FAR IS THAT RISKS IN SUCH UNDERTAKINGS MUST BE CONSIDERED HIGH AND THAT PRUDENT BUSINESSMEN WILL BE VERY CAUTIOUS.

WE BELIEVE THE SUBCOMMITTEE IS PROCEEDING IN THE PROPER DIRECTION TO ALLAY THESE RISKS; HOWEVER, WE HAVE CONCERNS THAT NEW RISK REDUCING LEGISLATIVE POLICIES IN THIS AREA ALONG WITH ADMINISTRATIVE IMPLEMENTATION WILL TAKE CONSIDERABLE TIME. OUR FEAR IS THAT, IN THE MEANTIME, ALL COMMERCIAL LAUNCH

SERVICES USERS WILL BE FORCED TO SEEK ALTERNATIVES OUTSIDE THE UNITED STATES. IN OUR LAST TESTIMONY TO YOUR SUBCOMMITTEE, MDAC RECOMMENDED THAT A GOVERNMENT SPONSORED MIXED FLEET APPROACH BE TAKEN TO PROVIDE A PREDICTABLE CAPABILITY AS SOON AS POSSIBLE. THIS FLEET WOULD CONSIST OF BOTH SHUTTLES AND ELV'S WHICH WOULD PERFORM ALL MISSIONS FOR BOTH GOVERNMENT AND COMMERCIAL CUSTOMERS. MAXIMUM FLEXIBILITY WOULD BE MAINTAINED TO ASSIGN MISSIONS TO EITHER ELV'S OR THE SHUTTLE AND THE COMMERCIAL CUSTOMER WOULD PAY THE SAME PRICE INDEPENDENT OF LAUNCH VEHICLE ASSIGNMENT. A GOVERNMENT SUPPORTED FLEET IS QUICKLY OBTAINABLE BY EXTENDING EXISTING ELV CONTRACTS. THIS APPROACH WOULD PROVIDE RENEWED UNITED STATES LAUNCH CAPABILITY AT THE EARLIEST POSSIBLE DATE AND ASSURE USERS OF A FIRM UNITED STATES LAUNCH COMMITMENT. THIS COULD ALSO PROVIDE A TRANSITION PERIOD FOR GOVERNMENT, IN CONJUNCTION WITH INDUSTRY, TO FURTHER IMPROVE THE THE CLIMATE IN WHICH COMMERCIAL ELV'S CAN BE COMPETITIVE. IF THIS INITIALLY GOVERNMENT FUNDED APPROACH IS NOT TAKEN THERE IS A STRONG PROBABILITY THAT COMMERCIAL INDUSTRY ATTEMPTS TO COMPETE MAY FAIL AND THE UNITED STATES WILL BE LEFT WITHOUT A SIGNIFICANT PORTION OF THE CAPABILITY WHICH HAS KEPT THE COUNTRY IN THE FOREFRONT OF SPACE OVER THE LAST TWO DECADES.

IT IS OUR CONTINUING RECOMMENDATION THAT ANY NEW POLICIES IN THIS AREA SHOULD NOT PRECLUDE USE OF THE SHUTTLE FOR COMMERCIAL MISSIONS, INCLUDING LAUNCHES OF COMMUNICATIONS SATELLITES. IN THE LATE 1970'S MCDONNELL DOUGLAS MADE TWO MAJOR BUSINESS DECISIONS BASED ON THE UNITED STATES POLICY TO UTILIZE THE SPACE SHUTTLE FOR COMMERCIAL MISSIONS AND PHASE OUT THE ELV'S PREVIOUSLY USED

FOR COMMERCIAL SATELLITE LAUNCHES. THE FIRST DECISION WAS TO COMMERCIALLY DEVELOP THE PAYLOAD ASSIST MODULE (PAM) UPPER STAGE FAMILY PRIMARILY USED FOR LAUNCHING COMMUNICATIONS SATELLITES FROM THE SHUTTLE. PRIOR TO THE SHUTTLE TRAGEDY IT APPEARED THAT THE PAM PROGRAM WOULD EVENTUALLY PROVIDE A RETURN ON OUR INVESTMENT. IF COMMERCIAL SATELLITE LAUNCHES ARE NO LONGER ALLOWED ON THE SHUTTLE, OUR OPPORTUNITY FOR A POSITIVE RETURN ON INVESTMENT WILL VIRTUALLY BE ELIMINATED. THE SECOND DECISION WAS THE DEVELOPMENT OF OUR ELECTROPHORESIS OPERATIONS IN SPACE (EOS PROGRAM), WHICH PROVIDES FOR MANUFACTURE OF VARIOUS PHARMACEUTICALS IN THE ZERO GRAVITY ATMOSPHERE PROVIDED BY THE SHUTTLE. THE EOS PROGRAM DEPENDS ENTIRELY ON THE SPECIAL ENVIRONMENT PROVIDED ONLY BY THE SHUTTLE. WITHOUT ACCESS TO THE SHUTTLE ITSELF, THE OPPORTUNITY TO CONTINUE OUR RESEARCH EFFORTS, WHICH WILL LEAD TO EVENTUAL PHARMACEUTICAL MANUFACTURING IN SPACE, WOULD BE TOTALLY DELETED. THEREFORE, THE ELIMINATION OF COMMERCIAL MISSIONS FROM THE SHUTTLE HAS SIGNIFICANT IMPACT ON CURRENT AND DOWNSTREAM BUSINESS OPPORTUNITIES FOR MCDONNELL DOUGLAS AND, WE BELIEVE, HAS A SIMILAR IMPACT ON THE SPACE INDUSTRY IN GENERAL.

WITH THESE COMMENTS AS BACKGROUND LET ME NOW MORE SPECIFICALLY COMMENT ON SEVERAL PORTIONS OF THE PROPOSED BILL.

o NASA PROCUREMENT OF 15 LAUNCHES (MINIMUM OF TWO LAUNCHES PER YEAR)-WE BELIEVE INITIAL PRODUCTION SHOULD BE UNDERSTAKEN AS SOON AS POSSIBLE A PART OF A GOVERNMENT SPONSORED MIXED FLEET FOR BOTH GOVERNMENT AND COMMERCIAL MISSIONS. ADDITIONAL CONTINUING ELV LAUNCH PROCUREMENT FOR

GOVERNMENT MISSIONS WOULD BE AN IMPORTANT NEXT STEP BEYOND THE GOVERNMENT SPONSORED MIXED FLEET TO PROVIDE A BASE FOR COMMERCIAL PRODUCTION. HOWEVER, THE PRODUCTION BASE, OF OUR PRINCIPAL COMPETITOR, ARIANESPACE, IS APPROXIMATELY 8 VEHICLES PER YEAR. WITH THIS BASE, AND STRONG EUROPEAN COMMUNITY SUPPORT, ARIANE HAS BEEN HIGHLY COMPETITIVE IN THE WORLD LAUNCH SERVICES MARKET WITH PRICES SEVERAL MILLION DOLLARS BELOW THE PREVAILING MARKET PRICE SET BY THE SHUTTLE. ARIANESPACE STATES PUBLICALLY THAT A PROFIT IS BEING MADE SELLING THEIR PRODUCT AT THESE PRICES. THE GREATER ARIANE PRODUCTION BASE CONTRIBUTES TO LOWER ARIANE UNIT COSTS, WHICH COULD BE PARTIALLY OVERCOME BY ALLOWING THE UNITED STATES COMPANIES TO SELL TO THE WORLD MARKET ON THE BASIS OF ADDITIVE COSTS. THE PRICE OF A COMMERCIAL VEHICLE UNDER THIS ARRANGEMENT COULD BE SET ON THE BASIS OF THE ACTUAL ADDITIONAL COSTS INCURRED FOR THE VEHICLE OVER AND ABOVE THE GOVERNMENT PROGRAM COSTS. LEGISLATION WOULD BE REQUIRED TO ALLOW THIS SPECIAL COST ALLOCATION PROCEDURE.

SHUTTLE PRICING POLICY - THE PRICES OF LAUNCH VEHICLE SERVICES MUST ULTIMATELY RECOGNIZE AND ADJUST TO THE WORLDWIDE COMPETITIVE ENVIRONMENT. ASSUMING A GOVERNMENT SPONSORED MIXED FLEET IS FUNDED INITIALLY, THE SAME PRICE FOR EQUIVALENT LAUNCH SERVICE SHOULD BE CHARGED INDEPENDENT OF THE LAUNCH VEHICLE AND CONTINUED EQUIVALENT PRICING IS NECESSARY TO FOSTER A COMMERICAL ELV INDUSTRY. WHEREVER POSSIBLE POLICIES SHOULD BE INTRODUCED WHICH ASSURE EQUITABLE USE OF

THE TOTAL LAUNCH VEHICLE ASSETS, BOTH SHUTTLES AND ELV'S. WE AGREE THAT SPECIAL INCENTIVES FOR RESEARCH USE OF THE SHUTTLE THROUGH THE JOINT ENDEAVOR AGREEMENT PROGRAM SHOULD BE CONTINUED.

IN SUMMARY, THE GOAL OF STIMULATING A RECONSTITUTION OF OUR LAUNCH VEHICLE CAPACITY IS EXTREMELY IMPORTANT TO THE UNITED STATES AND TO THE SPACE INDUSTRY. THE ACCOMPANYING GOVERNMENTAL LEGISLATIVE/ADMINISTRATIVE CHANGES WILL REQUIRE CONSIDERABLE TIME TO IMPLEMENT. TO MAINTAIN THE UNITED STATES LEAD IN SPACE DURING THIS PERIOD AND TO ASSURE THAT OUR PRESENT CUSTOMERS ARE NOT LOST FOREVER TO FOREIGN SOURCES, A GOVERNMENT-SUPPORTED MIXED FLEET IS RECOMMENDED AS THE IMMEDIATE APPROACH. TRANSITION CAN THEN BE ACCOMPLISHED IN AN ORDERLY MANNER TO INCLUDE AN ELV INDUSTRY, PREPARED, WITH MINIMUM GOVERNMENT INVOLVEMENT, TO COMPETE IN THE WORLD LAUNCH SERVICE MARKET.

THANK YOU AGAIN, MR. CHAIRMAN, FOR THE OPPORTUNITY TO PARTICIPATE IN THE FORMATION OF LEGISLATION ON ELV COMMERCIALIZATION AND THE RECONSTITUTION OF OUR NATIONAL LAUNCH VEHICLE CAPABILITIES.

May 15, 1986

BIOGRAPHICAL SKETCH
CHARLES A. ORDAHL

Mr. Ordahl is Vice President - Engineering and Operations, McDonnell Douglas Astronautics Company, Huntington Beach, California. He is responsible for directing the central engineering organization and all operations functions, including procurement, fabrication, assembly and test, and acquisition and maintenance of facilities. Prior to this assignment, he was the Vice President General Manager Space Transportation for McDonnell Douglas. His responsibilities included the development, production, test, and launch operation functions for all space transportation related activities at MDAC-Huntington Beach and launch sites. Mr. Ordahl has previously held positions such as Director of Engineering for the Delta launch vehicle. He was also responsible for directing development of the Payload Assist Module (PAM), and its derivatives, a commercial launch vehicle which was used for launching the first communication satellite from the Space Shuttle. Mr. Ordahl joined the Douglas Aircraft Company (later McDonnell Douglas) in 1956. He has a degree in Electrical Engineering from the University of North Dakota. He is a member of the American Astronautical Society and National Space Institute, and is an Associate Fellow of the American Institute of Aeronautics and Astronautics.

Mr. NELSON. Thank you, Mr. Ordahl.

[Pause]

Mr. NELSON. OK. We are discussing strategy here about there's an amendment that I have to offer on the floor on the DOD bill concerning NASA, but I think we have enough time here, so let's proceed.

Mr. Dealy.

Mr. DEALY. Mr. Nelson, Mr. Walker, thank you for the opportunity to appear before you and discuss the Transpace Carriers perception of all of this that's been going on in the last couple of days and the many months.

In attending yesterday's hearing, I was impressed by a couple of points that you made, Mr. Nelson, at the outset. One is the—the need at this stage for there to be some exhibition of leadership, that we have to move forward with some decisiveness.

And, second, that we probably have to make some hard decisions—not just ones in which we satisfy everyone, but ones in which as business managers have to, and you folks have to, where you have to slice the loaf in some direction in order to get something accomplished.

Recognizing also that the day is moving along rapidly and that you've got a lot of other things to do, I will try to address some of these issues in what you might say is fairly brutal candor, and hope that we can get some serious discussion going on how to resolve them.

In looking over your initiative that you proposed—the givens and then the policy actions—I'll comment specifically on some of those points. But I thought that there were two things that really ought to be added to those that evolve from yesterday's testimony and that I think are almost pre-conditions to addressing some of the other problems.

The first was the colloquy that took place with the Administrator concerning why NASA had or had not signed contracts. As a businessman throughout my life, I know that you will not get something done if you don't take the first step. So quite apart from the long-range debate as to is there a large enough market, isn't there, who will survive, who won't, what should the—what will the world look like in 1995—we have had a presidential policy statement some years ago; we have had RFP's issued by NASA; we've had serious companies, whether they're startup companies in which investors have placed their millions; or large incumbent companies that are major business enterprises; developed documents, negotiate; documents that have been sitting on tables.

If we do not force, find the mechanism, to get deals cut in some manner, nothing is going to happen. That's the precondition. And in my experience in—in areas such as this, there is enormous leverage that this committee has to get that done.

It is not so much that I'm trying to force NASA to make any one deal or any other deal, but I think it is very appropriate that in whatever your initiative is, that one of the preconditions to moving out is that NASA wrap up its negotiations with the interested parties one way or the other, and come back to this committee with the answer, so that we know, is there something we're going to build from, or is there really just continuous talk. That's issue number one.

The second issue—and this is something I run into regularly in dealing with companies on strategic direction or restructuring of them, et cetera—the unwillingness of people to face reality. One of the issues that came up yesterday was what is the manifest. What can be done over the near term assuming the most optimum case of the *X* number of shuttles and *Y* number of launches. But who in fact can be carried.

And we hear statements like there are so many needs out there, that what difference does it make if NASA buys two or three more Deltas, or if we do this act, or that act.

You may make policy in a broad sense, you sell customers one by one. You have to clear the field to get something done. And it's very clear to me that we have to face the reality of what are the number of payloads that could be carried on the shuttle across what timeframe. Get that established. I think it answers a lot of questions about so-called abrogation of contracts and other things—we will find out practically what can be done. And there will be an excess—all the numbers that we run show a very substantial number of payloads that cannot be accommodated. They should be cleared up, and the playing field should be cleared so that the commercial industry can operate in that sector.

So I can't emphasize too much the need to get the first acts done and to face the reality of what the true demand is versus the availability of resources.

Turning from that to the more specific issues in your—in the paper that we were provided with, it consisted, as I say, of givens and then provisions in a proposed statute. I'd just like to make a—brief comments, because an awful lot of the points that I would have made are in my written statement which I've submitted for the record, and have also been ably handled by my colleagues here at the table.

The first is that your—your initial points on the need for reliable access and the necessity for a mixed fleet of shuttles and ELV's are fully concurred in by Transpace—there's no question about that.

With regard to the third given, that the U.S. Government honor existing commitments to launch commercial payloads on the shuttle, again, I think if you face reality you will find out what can be done and turn it into more of a performance issue than will we honor commitments or will we not honor them.

But I think that I'd like to see that given amplified to clear up an area that is really the playing field that the commercial entities need. And that is that expendable launch vehicles, not the shuttle, but expendable launch vehicles for commercial and foreign customers must be provided by private industry and not by the Government. Note that I've said expendable and note that I've said commercial and foreign. We are not arguing—at least, I'm not—that—that the shuttle will not be used for Government payloads, nor am I arguing against the shuttle being used as a backup.

If it's a true backup, I think it's an asset, and—and one that will help support this industry and should not be considered as an either/or proposition. But it must truly be a backup. And the way I would describe it is that it may be employed only in those cases where the ELV industry certifies to the Government that the need cannot be satisfied by an ELV. Something has to be taken out of the arbitrariness so that you open up the field.

I have also added a given, one that I think is critical—and I think it goes back to the testimony yesterday. I believe that in addition to honoring our commitments to users, we have a fundamental obligation here to honor the commitments—the good faith negotiating arrangements worked out over years to the launch services providers. These people have been working—whether it's Transpace or my cohorts—have been working with their government for 3 to 4 years to try to effect a simple set of transition arrangements.

I don't think that we can continually reshuffle the decks, stop negotiations, start them, go into holding periods. There is nothing to my knowledge that has been holding up the agency from closing the existing commitments with the use—with the launch services providers. There may be all kinds of problems of what you would do after that, but if we don't do that first part, we frankly have nothing realistically to sell to people. And we've pressed very hard on that subject matter, as you know.

I state on page 5 of my statement that I see three basic steps required to get this industry going.

First, the Government must define a market area which will be open to commercial ELV launch service providers and where the Government will not compete with its own industry for commercial customers.

And the emphasis there is on the Government competing with its own industry for the commercial customers. It's the marketing aspect of it, not the use of the shuttle as a backup in cases of unavailability or—and it's—and I'm not addressing shuttle-unique payloads. They should go on the shuttle. I'm talking about defining some playing field within which our Government is not going to compete with its own industry. I think that's a formidable task, but it's the one, hopefully, this committee can address and come up with a resolution on.

The second point is even more critical. Those conditions must be established for the industry to start now. We've got to find some mechanism to get the agreements cut. You've heard from other people that there are customers now inquiring, people trying to get launch dates, et cetera—we're experiencing the same thing. The pent-up demand is out there—you've heard it from the users. There simply is no launch available. We have to put the emphasis on now.

And I say admittedly, a little bit caustically, that we are creating a vacuum into which foreign competition is stepping. It is not so much that they're charging into our market as we are leaving it open. And that should never be the policy of this Government.

My third point is perhaps a little more controversial, and I'm speaking again only of ELV's. NASA must be precluded from being in the ELV business to serve commercial or foreign users—directly or indirectly. It's not their business. If we're going to commercialize, we're carving out some area that the industry will handle. If we're not going to commercialize, it's why I say I intended to speak with some candor—let's face that issue and not commercialize. But you can't be half in the pool and half out of the pool at this stage in this—in this particular business area.

Mr. **Nelson**. Well, so you would mean where there's a contract or a deposit, to have those people come over to the ELV industry; is that right?

Mr. **Dealy**. No, what I'm saying is this: that NASA should be out of the business—yes, if you're talking about NASA now serving that commercial customer with an ELV, that ELV should be purchased through the industry.

Mr. **Nelson**. Including where there's an existing contract?

Mr. **Dealy**. That's correct, because my view of honoring existing contracts on the shuttle—and I'm not sure that anyone's really focused on these contracts. Normal launch services contracts are ones in which if the Government cannot provide the launch with the next period of time from the scheduled date, the customer is free to go elsewhere and to get his money back. And where you just have a reservation, you don't in fact even have a date or, in many cases, a specific price.

But where we're trying to serve that issue, where we're acknowledging that the shuttle cannot handle the particular mission and we turn to an ELV, that should be the stimulus to get this industry going. That's precisely the way it should move. It should not become a startup and then stopping Government procurement to get back into the ELV business.

Mr. **Walker**. So you have no problem with NASA buying launch services from the commercial industry—you just don't want NASA buying ELV's to fly those loads?

Mr. **Dealy**. I have no problem with NASA buying commercial—buying launch services from the industry to serve Government needs. I have absolutely—see no reason for nor understand why someone would want NASA to be buying launch services in order to launch commercial customers if the policy of the Government is to try to stimulate a commercial industry.

It just puts an intermediary in that is totally unnecessary and, in fact, has a different interest than the—than the economic interest of the commercial launch services companies.

Mr. **Walker**. Well, if I just follow up for a moment.

But the problem is that we have some commercial customers out there right now that have signed contracts with NASA that we've—that we would have some problem because they've already put money into those contracts.

Mr. **Dealy**. Uh-huh.

Mr. **Walker**. And—and the question becomes, you know, how—how do we work our way out of the maze that we're—that we're now in. Now, I guess what I'm asking is, do you have a problem with NASA buying launch services in order to take care of that that they have already contracted for?

Mr. **Dealy**. If they're—if they are a commercial customer, absolutely. NASA should not go back into the ELV industry. The RFP that was issued in 1982 stated that NASA was getting out of the business, at least as regards Delta—asked people to come in and bid on it. We worked 4 years to effect an agreement with them. All of the customers that you may be talking about have approached us. Some of them have signed letters with us to acquire their launches through us. This should be the stimulus to get the industry going. This is the economic base. The one that does not require the Government to use appropriated funds to buy 15 vehicles—turning those contracts—turning those customers over to the ELV industry.

Mr. WALKER. And those customers should have to eat all that they've paid to NASA so far?

Mr. DEALY. No, no. The—the NASA contract provides, that if NASA can't provide the service at the time frame it was committed, that the customers get their money back. The money should be returned to those customers, and they should find their lift from the ELV industry.

OK, I think that the next point I'd just like to comment on is the foreign competition one, in order to move quickly through this.

We've talked a lot about foreign competition, about the threat of—of Ariane, et cetera. One suggestion I would have is that in looking at this, we should provide our STR—our Special Trade Representative—and our Government officials who, when negotiating with these countries, I think with the appropriate leverage to deal with that in the normal course. And one way to do that is to agree—and this gets into the area of subsidization support—from our perspective in the industry, some kind of cost support, et cetera, is not required. And that's over and above providing the facilities on the most economical basis they can be to stimulate the industry.

But we recognize that situations may occur in the future where there are competitive forces in the international marketplace. We would like to see at the outset, in the conception of this industry, the proposition that the U.S. Government will be free at any time to provide whatever support is needed to this industry to meet the actions of foreign competition.

We think that much as the shuttle as a backup provides leverage to our Government in the negotiating around the world, that provides our Special Trade Representative with considerable leverage in dealing on a case-by-case basis with this type of activity as it comes up.

The threat that you can match the subsidy quite often can block the subsidization from occurring.

I don't think you can answer all those questions upfront but I think that principle would be a very good one. It's rare that we have an opportunity at the inception of an industry to set up conditions to keep the playing field correct in the world market.

Then turning specifically to your initiatives, away from your givens. I have already talked about initiative No. 1 with Mr. Walker in terms of what I believe the involvement should be of NASA.

I have a point here that I think is important in terms of the position raised by some of my colleagues up here, i.e., in terms of what can be done in the early time frame. The pentup demand is here now, the people need launch in the next couple of years.

In the case of the Delta specifically, there is some residual hardware that is in existence. There are many customers who like early—who need an early launches. If we talk about going out and making procurements, or if we talk about starting up new production lines, I would hope we would put right in the beginning of our legislation, or regulations, with regard to this, that we not through any Government procurements so occupy the production lines that there's no room to phase in the needs of the commercial users.

So, in the case of residual hardware, it should be made available as much as possible to provide early lift for those commercial users who are waiting for payloads. If in fact you go forward with any procurement of the—of new vehicles for Government needs, it should be so phased that you don't wind up only being able to purchase the commercial needs at the end of the procurement cycle.

That—my view is that there should be at least some holes available throughout that production cycle to serve the early needs of users—or else, again, we are not going to address the current problem of how to fly off the backlog that exists.

Your proposed statutory initiatives No. 2 and 3, I think are very solid provisions. I emphasize particularly the pricing one that you've discussed with many others in the last couple of days. It is critical that we remove any artificial economic incentives for NASA and users to seek to arrange shuttle launches.

With regard to your initiative No. 4, I must confess that I really am not quite sure why that is needed in the framework that it is. I understand your objective, to seek to discourage NASA from active pursuit of commercial customers. I would look at it the other way around, that your legislation should direct NASA not to pursue commercial customers—that that should be the playing field that is reserved to the commercial industry.

I have a lot of experience in other areas—in the telecommunications field, with the FCC, and the startup of the satellite industry, et cetera. I suggest that where NASA does in fact do that, there ought to be some remedy—the right of the commercial industry to challenge any NASA procurement of lift for a commercial customer.

There are many provisions before the FCC and the startup of the satellite industry where it was recognized in order to get the industry going, you were going to have to give the new entrants some rights versus the incumbents, or there would never be any arrangements to make things happen.

I think I would close on——

Mr. NELSON. OK, the time has come for me to go off for this NASA amendment on the DOD bill. So I am going to ask Mr. Walker to continue the hearings. And then when you get at a point that you adjourn, if you would, check to see if I have not offered the amendment, if you could come on and speak on the amendment, I would appreciate it.

Mr. WALKER. All right.

Mr. NELSON. All right, good.

Mr. DEALY. I was just going to close with two points.

The first one is that the core issue was that the Government cannot compete with its own industry and expect there to be a viable commercial segment. And I think I've made that as strongly as I can.

The last point, though, is I think this is an appropriate time for fundamental decisions on the basic mission of NASA. And I think it keeps on swirling around in all the conversations that we've had.

If NASA is to continue to be a transportation monopoly to space—if that's the sense of this committee, or the sense of the administration, then we ought to face that issue and figure out how to go about doing it.

If the concept is that that is not its role, I think we would really be serving NASA much better by refocusing it on technical development, on space exploration, on many other missions that have been the traditional missions of NASA, and letting it get on with its strategic plan in those areas to make things happen, and not endlessly keep on going back and forth on—on the depth and degree to which its in all the areas of space transportation.

I can't emphasize that too much because I feel that that's an underlying cause of a lot of the problems that we have. And NASA is in a position of trying to hang onto everything while it figures out what its focused position is going to be going forward. And I think it's needed that that decision be made, which I think will clarify some of the other ones that we have been discussing here today.

And I guess my—my final point would be, anything that this committee can do to move those contracts along with NASA and let us get out and start serving customers who are now approaching the companies in greater numbers than they have been in the past, would be a major step forward in getting this industry moving.

Thank you.

[The prepared statement of Mr. Dealy follows:]

STATEMENT OF TRANSPACE CARRIERS, INC.
TO THE SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
AUGUST 14, 1986

Transpace Carriers, Inc. is pleased to have the opportunity to present its views to the Subcommittee on appropriate legislative action for development of an efficient, competitive commercial Expendable Launch Vehicle (ELV) industry. In his July 31, 1986 letter to Mr. David Grimes, Chairman of Transpace Carriers, the Subcommittee Chairman requested Transpace's comments on a potential legislative initiative entitled "Commercial Space Launch Policy". In addition, you asked Transpace to provide any additional thoughts it might have as to how this proposed initiative could be modified to maximize its effectiveness.

Transpace will address each of these areas - Comments On the Proposed Initiative and Proposed Modifications to Maximize its Effectiveness - in turn.

I. BACKGROUND

At the outset, some historical information on Transpace's four-year Odyssey to establish a commercial Delta-class launch services company may highlight the ambiguous policy-making and bureaucratic maneuvering so characteristic of activity (or lack thereof) in this area over the last few years.

Transpace Carriers, Inc. is the corporation formed in 1982 specifically to commercialize the Delta class of launch vehicles. As the members of the Subcommittee know, the Delta series is a mature, highly reliable Expendable Launch Vehicle system capable of lifting medium weight payloads into geostationary orbit. By the early 1980's, NASA had planned to phase out this line of launch vehicles and to concentrate its resources on the Space Shuttle. With the President's statement of space commercialization policy in 1983, NASA's disinterest in further development of the Delta line, and increasing use of space by commercial companies and foreign governments, Transpace and its founders/investors saw an opportunity for the development of a commercial expendable launch services company in this country. Toward this end, a Preliminary Agreement was negotiated with NASA in 1984 and the parties have been working since that time to develop the definitive arrangement for transfer of the Delta system to Transpace. Transpace does not intend to manufacture the vehicle - that will be accomplished by the existing team of qualified Delta manufacturers; Transpace does intend to effect development of enhanced versions of Delta capable of lifting heavier payloads into geostationary orbit.

Since 1984, the establishment of a commercial Delta program by Transpace has been frustrated by a series of events to some degree beyond the control of either or both parties (NASA and Transpace). First, the nation adopted a Shuttle pricing policy to stimulate commercial users to launch on the Shuttle. These substantially discounted rates placed the Government in the anomalous position of competing with its own nascent industry and doing so with substantial inequities in the pricing area. About the time the Shuttle pricing situation was partially rectified in 1985, NASA pressured Transpace to release certain Delta residual hardware (essential for early startup of the program) previously committed to Transpace in its Preliminary Agreement, on the ground that some portion of this hardware was required for SDI missions. More recently, NASA has refused Transpace access to this hardware on the more generic proposition that it "may be needed for other government missions". The result is that Transpace to this date has been seeking to develop a commercial business either in the face of preferential government pricing policies favoring Shuttle launches or in a condition where it does not have any hardware available to assure customers a launch in the next two-to-three-year time frame.

The frustrations of Transpace in starting this business have been further exacerbated in the last two to three months by a series of conflicting positions taken by NASA with our company. On the one hand, we have been assured that NASA would not re-enter the ELV business on its own. On the other hand, we have seen NASA commit to carry an Indonesian satellite on a Delta and we have seen initiatives by NASA to procure Deltas (using some of the allegedly inviolate residual hardware required for government missions) in order to provide lift to commercial satellite operators. We were also advised by NASA management that it wished to move forward with definitization of our commercialization agreement but that it has been thwarted in so doing by the reaction of the four pertinent committees in Congress (including this Committee); yet, when we check with staff members on the various committees we are told no such stifling action is being taken by the committees. We are submitting for the record our relevant correspondence with NASA over the past three months so that you may obtain a better perception of the tactical maneuvering and inaction that are preventing the startup of this industry and of our company's efforts to work cooperatively with the Government in accomplishing such startup.

II. COMMENTS ON THE PROPOSED LEGISLATIVE INITIATIVE

Turning to the specific points in the draft "Commercial Space Launch Policy" provided to us with your July 31, 1986 letter, we commend the Subcommittee for its effort to address the problem from a strategic perspective. Too often, organizations looking at this issue focus either on the Space Shuttle or on one particular ELV and do not provide a broad-based assessment of what should or should not be done.

Your paper is divided into two sections: "Givens" and "Provisions in a Proposed Statute". With regard to the "Givens" we comment as follows:

Your first two points on the need for reliable access and the necessity for a mixed fleet of Shuttles and ELV's are concurred in by Transpace.

With regard to your third "Given" -- that the U.S. Government should honor existing commitments to launch commercial payloads on the Shuttle -- we believe this needs further definition as to what is meant by commitment and also that this statement needs to be balanced against reality. In our view, the Shuttle will simply not be available in any realistic time-frame to serve commercial customers -- NASA's own projections to the recent Airlie House conference convened by this Committee confirm this fact. By promising these customers false hopes of Shuttle launches, the Congress and the Administration significantly impede the start of a commercial industry. In any event, this "Given" should include the following accurate statement of the situation for nonshuttle launches: "Expendable launch vehicles for commercial and foreign customers must be provided by private industry and not by the Government". With regard to the comment in this "Given" that the Shuttle should remain available to commercial users as a "backup" vehicle, we have no problem with this provided the Shuttle is truly a backup, i.e., it may be employed only in those cases where the ELV industry certifies to the Government that the need cannot be satisfied by an ELV.

There should also be a "Given" added -- the U.S. Government should honor its commitments to launch services providers, such as Transpace, as opposed to the current untenable situation of oral promises and written ambiguities designed to preserve to the Government agency all options at all times -- with a predictably dismal record of practical accomplishments in commercializing spacelift.

With regard to your "Given" that America can not concede the ELV launch business to foreign competition, we make the following assertion: After working intensively for four years and expending more than $5 million of investor money, merely trying to get Government agencies out of the way in order to let this industry start, our perception is that the real threat to an American ELV industry comes not from France, China, Russia or Japan. It comes from Washington, D.C. and from an unwillingness to take the necessary decisive steps in the near term required to initiate this industry.

These required steps are straightforward and threefold:

1. The Government must define a market area which will be open to commercial ELV launch service providers and where the Government will not compete with its own industry for commercial customers.

2. The conditions must be established for the industry to start NOW. The window of opportunity is current: pentup demand; exorbitant pricing by the French; many U.S. and foreign users desperate for lift. Failure to take decisive action during this window of opportunity will eliminate the economic base so essential to a successful startup. Mature vehicles, with existing residual hardware - such as the Delta - are ideal candidates for immediate transfer to the commercial sector. If we continue to debate philosophical policy issues and take no action to commercialize Delta, we are maintaining

the vacuum into which foreign competition will step. It is not that foreign competition is aggressively taking business away from U.S. companies; our inconsistent Government policies are abdicating the market to them.

3. NASA must be precluded from being in the ELV business to serve commercial or foreign users - directly or indirectly: this is what commercialization means; and NASA may not carry any ELV-launchable commercial or foreign payload on Shuttle for any reason at a price below that of a comparable U.S. ELV.

This leads into your fifth "Given" -- that private industry has to date not developed a commercial ELV industry. That statement to be accurate should be completed as follows: "in part due to the Government's marketing in competition with ELV's, Shuttle discount pricing policy decisions and Government inaction in effecting transition to the private sector." If we are unwilling to state as a "Given" what is known to each segment of the industry - (both manufacturer and user) - we are further compounding the decisional morass in which the space launch industry is foundering by once again denying reality.

In the next sentence in this "Given" - "Some government steps must be taken to provide a climate in which U.S. commercial ELV's can be competitive" we would strike the word competitive and substitute what we believe to be a more accurate statement - "Some government steps must be taken to provide a climate in which U.S. commercial ELV's can be provided a marketplace free from U.S. Government competition and where the U.S. commercial ELV's can have a fair chance vs. foreign competition."

III. PROPOSED MODIFICATIONS TO MAXIMIZE EFFECTIVENESS OF SUBCOMMITTEE'S INITIATIVES

With regard to your statutory initiatives, Transpace has the following comments:

Initiative Number 1 - in our view there is no need or rationale for NASA to be involved in procuring any ELV launches. If, in fact, a government agency is to aggregate U.S. Government payload needs, this should be done by an agency that is not also seeking to compete with its own commercial industry. NASA must agree once and for all that it will not compete with U.S. ELV's for commercial and foreign business or commercialization will remain a hollow concept in the space launch field.

Concerning the second sentence in your Point #1, "These launches should be purchased over a five year period beginning in 1988 and should occur at a rate of at least two per year", we would add "These launches may not be used for commercial and foreign payloads." This gets back to our consistent, fundamental point that there must be some playing area defined in which the Government will not compete with its own industry.

Finally, any procurement of ELV's for Government uses must be phased in such a manner that some part of the manufacturer's capacity is reserved for commercial/foreign payloads to be purchased by the commercial launch services contractors; otherwise, your policy to stimulate commercialization will in fact frustrate it due to lack of hardware availability for near-term commercial requirements.

Your proposed statutory initiatives Numbers 2 and 3 are sound provisions and will, in fact, provide a solid framework for the initiation of a viable ELV industry. The item on pricing is particularly important. Unless you agree to a standard that removes the artificial economic incentive for NASA and users to seek to arrange Shuttle launches, you have doomed the U.S. ELV industry before it starts.

With regard to Legislative Initiative #4 - Transpace believes it is the wrong approach to seek to discourage NASA from "active pursuit of commercial customers" by some bureaucratic game of where you spend allegedly excess funds. Rather, NASA should be directed not to pursue commercial customers; there should be severe penalties if, in fact, NASA does pursue commercial customers including the right of the commercial industry to challenge legally any NASA procurement of lift for a commercial customer.

In addition, we believe it is anomalous for this committee, with all its knowledge and understanding of the issues, to continue to talk about full cost of providing a Shuttle launch as being merely $74 million in 1982 dollars. We provide for your perusal an article in the Wall Street Journal last week that sets out more realistic numbers derived, in fact, from the U.S. Government's own internal studies of Shuttle cost. But, more significantly, the use of incorrect cost figures is symptomatic of the numbers games pervading the launch policy debate: how many customers are on the manifest, projections of unreasonably high Shuttle launch rates and accounting gimmickry to demonstrate that the Government actually makes a profit when it launches a commercial payload on the Shuttle. If you take the Shuttle budget for a given year and divide by the number of achieved Shuttle launches for that year, you will find out what each launch cost the taxpayers of the United States. And I can assure you that is far more than $74 million. Such a computation doesn't even take into account the provisioning that should be made for Shuttle replacement and upgrades to keep the system viable over the long term. This continuing order of magnitude misuse of numbers is intellectually dishonest and clouds the whole policy debate on space launch for the United States.

Regarding initiative #5 - it would simply be our sense that private industry should be encouraged to establish the quality assurance laboratory in conjunction with the insurance underwriters.

IV. CONCLUSION

As is obvious from our comments, Transpace agrees strongly with the Subcommittee's efforts to move the situation forward in a timely manner and obtain assured access to space with a strong U.S. industry lead in this business area. We are equally convinced, however, that the misuse of data and the emotional attachment to certain concepts in defiance of reality and common sense are dramatically impeding the startup of this industry. The demand is here NOW. Mature vehicles, such as Delta and others, await decisions that will free up a commercial playing field. The core issue is that Government cannot compete with its own industry and expect there to be a viable commercial segment. If the Subcommittee fails to come to grips with this central issue and is not decisive on what is the area in which NASA will be permitted to play, and what area will be reserved to the private sector, then all the legislative initiatives and Adam Smith pronouncements will just prolong the current unsatisfactory condition of no activity and a marketplace ceded to foreign competition. Both nature and business abhor vacuums.

This is also the appropriate time for fundamental decisions on the basic mission of NASA. If NASA is to continue to be the transportation monopoly - the U.S. airline for space for all time and all users - the Subcommittee should face that issue and address it with the Administration. If it is not, if NASA is to redefine a focused mission aimed at space exploration, technical development, etc., then it should be mandated to do so, develop a strategic plan to accomplish same and get on with addressing a realistic future. The current environment -- where NASA receives no fundamental direction as to its basic mission but is left struggling to hang on to every bit and piece of space transportation -- is a fertile breeding ground for the maneuvering and inaction so frustrating to Transpace and other potential providers of commercial launch services.

JOHN F. DEALY

John F. Dealy is Senior Advisor to the Board of Directors of Transpace Carriers, Inc., a Maryland Corporation formed in 1982 to commercialize the Delta-class of launch vehicles.

Mr. Dealy is also Distinguished Professor, Georgetown University School of Business Administration, where he teaches Business Policy in both the undergraduate and M.B.A. programs, Negotiated Mergers and Acquisitions in the M.B.A. program, and Business Planning in the Law School. Mr. Dealy is also Of Counsel to the Washington law firm of Shaw, Pittman, Potts and Trowbridge and an advisor to technology companies on management, mergers and acquisitions, strategic planning and disputes resolution issues.

Mr. Dealy was a General Motors National Scholar at Fordham College where he graduated magna cum laude with a B.S. degree in 1961, and a Root-Tilden National Fellow at the New York University School of Law, where he was Notes Editor of the N.Y.U. Law Review and received his LL.B in 1964.

From 1976 until early 1982, Mr. Dealy was president and chief operating officer of Fairchild Industries, where he spearheaded the company's acquisition program (including its merger with VSI Corporation in late 1980); and where he played a major role in Fairchild's military/commercial aircraft and telecommunications developments (including the Applications Technology Satellite program for NASA; the A-10 close-air-support fighter for the U.S. Air Force; the SF-340 commercial aircraft joint venture with Saab of Sweden; the establishment of American Satellite Corporation in 1972 and its partnership arrangements with Continental Telecom in 1980). Prior to 1976, Mr. Dealy held a number of management positions at Fairchild and its subsidiaries (e.g., executive vice-president, chief financial officer), and served as an Attorney-Advisor to the Secretary of the Air Force (1964-1967). In addition to his Fairchild responsibilities, Mr. Dealy was Chairman and Chief Executive Officer of American Satellite Corporation (1977-1980) and Chairman of Space Communications, Inc. (1981-1982) (a partnership of Western Union, Continental Telecom and Fairchild).

Mr. Dealy is currently Chairman of the Finance and Economics Committee of the High Technology Roundtable in the State of Maryland; Director of the First National Bank of Maryland; a member of the Economic Advisory Council to the County Executive, Montgomery County, Maryland; and a member of the President's Task Force on Technology of the Greater Washington Board of Trade.

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June 1986

Mr. **Walker** [presiding]. Thank you.

Mr. Koopman.

Mr. **Koopman**. Thank you, Mr. Walker.

I am pleased to be here today to respond to the legislative initiatives proposed to aid the commercial space transportation industry.

American Rocket Co.'s business is the transportation of payloads to and from earth orbit, a package delivery service to outer space. In order to provide this service, AMROC will manufacture and operate its own launch vehicles. We believe that by sacrificing the race car performance of military missiles for the cost-efficiency of a delivery van, we can build rockets industrially rapidly and safely and economically.

Our technical approach includes an expendable launch vehicle built of hybrid engine modules, which have significant advantages in development, production, operation, and safety over conventional solid or liquid rockets. Among the advantages is that our proposed launch system is environmentally clean and is not subject to explosive failure.

We are currently testing rocket engines at the Air Force Rocket Propulsion Laboratory at Edwards Air Force Base.

The need for space transportation service, we believe, is expanding, expecially for smaller, 1 to 2-ton payloads. And we believe that hundreds of payloads are available to commercial carriers before 1992.

The basic legal and regulatory structure to support the private launch vehicle business is in place. We use national range and test facilities through the provision of the Commercial Space Launch Act and NSDD 94. We do lease facilities from and will sell services to the U.S. Government but will not produce rockets as a Government contractor.

We intend to demonstrate our ability to provide the next generation of space transportation by delivering several payloads to low earth orbit in the near future. We will also provide the capability to return payloads from orbit, and to that end are working with experienced suppliers to provide automated flyback spacecraft for commercial service. These suppliers have previously made hundreds of U.S. satellites which have flown reconnaissance missions back from space with extremely high reliability.

In order to provide this launch service on the world market, we are counting on the policy support of Congress and the administration. Transportation to space can and should be an ordinary commercial event. AMROC expects to accept packages for delivery to orbit much as any transportation service currently will accept packages for delivery to my front door.

We see the policy task at hand as transferring the commercial space transportation service from the U.S. Government to the private sector. As I think everyone sitting at this table has reflected, this transfer is essential to assure access to space for all American users, to the growth of a healthy American commercial launch industry, and to continued innovation and development and lowering of costs in the transportation field.

The U.S. private sector can provide the launch services to meet the needs of all the space users. We can meet any and all foreign competition. And we believe that private development and operation of launch vehicles can significantly reduce the cost of space transportation. All these things can happen provided that the U.S. Government ceases competing with and threatening to compete with its own citizens and taxpayers.

Recent statements from launch customers arguing that NASA should continue to be in the commercial space transportation business because the private launch business has failed to emerge is simply an affirmation that NASA has undercut the development of that business through heavily subsidized operations, has discouraged existing and new launch vehicle manufacturers from entering the business, and had taken steps which the investment banking community sees as severely restricting the opportunities for new launch vehicle developers.

The launch needs of the U.S. Government all by themselves represent a significant part of the market and potentially a very important source of support for the U.S. private launch industry. We believe the Government should be purchasing services instead of launch vehicles from the U.S. private sector, and that this action would not be a special favor or a subsidy, but would be an ordinary purchase of services by the Government.

We believe that this does not require any extraordinary policy change or special program, and that such purchases would be the most cost effective and appropriate means of procuring the launches for U.S. Government needs, as well as the single most effective means of aiding the U.S. launch industry against subsidized foreign competition.

The U.S. Government role in space transportation should be similar to its role in other transportation areas. It should regulate. It should represent the industry internationally in trade negotiation. It should provide support infrastructure such as launch sites and tracking facilities, just as it provides air traffic control, provides highways, provides safe shipping lanes to other transportation modes. And it should support advanced research and development.

NASA is chartered as, and should be a research and development organization, not a space trucking service. The space shuttle is useful primarily for specialized missions such as man-tended cargos and large payloads. It is not cost effective for ordinary launch use and it should provide launch service only for shuttle-unique payloads. This use will keep the shuttles fully occupied for the—forseeable life of the fleet under any kind of realistic operating scenario. And I think we heard Dr. Fletcher say that this use could effectively keep the fleet tied up through the mid-1990's in his testimony yesterday.

We see no justification for the U.S. Government spending large amounts of tax money competing with its own taxpayers and delaying the emergence of a fully competitive private launch industry.

I'd like to offer some specific comments with regard to your proposed measures. The thought of having NASA involved in the Government's procurement of launch services from the private sector, except for NASA's own needs, is unwelcome and unhelpful. In many ways it's worse even than the current situation, primarily because competent buyers and competent sellers don't need a middle man. Realistically, much of the NASA bureaucracy is hostile to the emergence of this industry. And so long as NASA has aspirations to remain a commercial space transportation provider it will compete with the other launch service providers.

Only a few years ago, we saw NASA requesting assistance from marketing consultants to help NASA defeat domestic and foreign competition. Now, the foreign competition, I have no argument with. What NASA's doing, defeating domestic competition, most specifically the gentlemen seated at this table, I have no idea. And we see no evidence that this attitude has changed.

The pricing policy for the shuttle, we don't believe is as important at this time as the use policy. We believe if there's a reasonable use policy and a reasonable and believable statement by NASA regarding how many payloads they can carry over the next few years, that the question will go away. However, any pricing policy that even remotely reflects the real cost of using the shuttle will result in a Shuttle price far higher than any competing expendable launch vehicle.

American Rocket supports continuation of programs designed to encourage commercial experimentation on the shuttle, particularly where such experimentation makes good use of the shuttle's unique capabilities. This includes JEA's and Getaway Specials. These are extremely appropriate uses of that very unique national resource. However, routine launch of payloads which could be carried up on ELV's only serve to perpetuate the current situation and to stifle the private business sector.

I believe I heard the chairman, for example, talk about having a backup ticket in your back pocket. I believe as long as NASA is still selling tickets of any kind that this is a great disincentive to the emergence of any U.S. competition.

Returning revenues from the sale of the shuttle services to the Treasury is, we believe, an ineffective means of discouraging NASA competition, as several other people up here have said, there should be a clear policy statement removing NASA from competition. And, again, with any honest accounting of shuttle launch costs, particularly in the post-*Challenger* environment, we believe there will never be any surplus revenues over launch costs.

With regard to the other provision making launch facilities available at a direct cost American Rocket Company currently is purchasing the use of Government facilities at additive cost. I believe we heard General Rankin say yesterday that after considerable discussion between his staff and yours, that the distinction between direct cost and additive cost seems to be a semantic one—certainly additive cost if it more clearly reflects the intent of this committee, should be included in the language.

Encouraging any sort of private, nonmandatory group to review launch vehicle reliability is an idea which has been considered many times over many years. Obviously, there's a hazard that such a body would become a barrier to the entry of any new and innovative technologies, especially if it were to function as a mandatory regulatory body.

The emergence of a commercial space transportation industry will create new challenges for all branches of government. And legislative attention certainly is appropriate for many of the matters that have been touched on here. The most pressing need—and I think you've heard this from everyone here—is for a clear signal from the Government that the emergence of a commercial space transportation business will not continue to be blocked by competition from the Government. If the administration does not provide such a signal, Congress must.

The most useful thing that could be done by Congress to support the commercial space transportation industry would be legislation encouraging the purchase of selected Government-required launch services from the private sector. However, a NASA role in choosing the launch providers seems to be not only unnecessary but counterproductive.

The sooner that the Nation revises its space plans to take the current realities into account, the sooner it will be able to return to planning the future in space that Americans want, expect, and deserve.

The private launch transportation industry is an indispensable part of America's future in space, and the sooner the Nation makes the decisions needed to encourage that industry, the sooner the Nation can move forward in space.

I thank you very much.

[The prepared statement of Mr. Koopman follows:]

STATEMENT OF
GEORGE A. KOOPMAN
PRESIDENT, AMERICAN ROCKET COMPANY

BEFORE THE

SUBCOMMITTEE FOR SPACE SCIENCE AND APPLICATIONS
COMMITTEE ON SCIENCE AND TECHNOLOGY
UNITED STATES HOUSE OF REPRESENTATIVES
AUGUST 14th, 1986

AMERICAN ROCKET COMPANY
MENLO PARK, CA

MR. CHAIRMAN, Honorable Members of the Subcommittee:

I am pleased to be here today to respond to the legislative initiatives proposed to aid the commercial space transportation industry. Commercial space transportation is a developing business, and we hope that these hearings will signal the opening of a dialog between launch providers and the Congress.

AMROC: A PRIVATE SPACE TRANSPORTATION INITIATIVE

For those who are unfamiliar with American Rocket Company, our business is the transportation of payloads to and from Earth orbit, a package delivery service to outer space. To provide this service AMROC will manufacture and operate its own industrial launch vehicles. By sacrificing the race car performance of military missiles for the cost-efficiency of a delivery van, we can build industrial rockets rapidly, safely and economically.

AMROC's technical approach includes an expendable launch vehicle built of nearly identical hybrid engine modules, which have significant advantages in development, production, operation, and safety over conventional solid and liquid rocket engines. AMROC is currently testing its rocket engines at the Air Force Rocket Propulsion Laboratory, Edwards Air Force Base, California. Our proposed launch system is environmentally clean, and is not subject to explosive failure.

The need for space transportation service is expanding, especially for ton-sized payloads. Hundreds of payloads are available for commercial service before 1992. Our prospective major payloads include DoD test articles, remote sensing and communications satellites, and commercial materials processing systems. A dozen market categories are projected for our capabilities by the late 1980s. Major new markets for space station consumables and other on-orbit supplies will open in the early 1990s.

The basic legal and regulatory structure to support the private launch vehicle business is in place. AMROC uses national range and test facilities through the provisions of the Commercial Space Launch Act and National Security Decision Directive 94. AMROC leases facilities from and will sell services to the US Government, but will not produce rockets as a government contractor.

American Rocket Company will demonstrate its ability to provide commercial service by delivering three payloads to low Earth orbit in the near future. AMROC will also provide the capability to return payloads from orbit, and to that end is working with capable suppliers to provide automated flyback spacecraft for commercial service. Similar spacecraft have flown hundreds of US reconnaissance missions back from space with extremely high reliability.

American Rocket Company is building the next generation of space transportation for its customers, public and private.

FEDERAL POLICY ISSUES IN COMMERCIAL SPACE TRANSPORTATION

In order to provide this service on the world market, we must count on the policy support of Congress and the Administration. Transportation to space can and should be on an ordinary commercial basis. American Rocket Company expects to accept packages for delivery to orbit much as any transportation service currently accepts a package for delivery to my front door.

AMROC sees the policy task at hand as guiding the transition from the US Government as the provider of space transportation service to the private sector as the primary provider of space transportation services. This transition is essential to assured access to space for American users, to growth of a healthy American commercial space transportation industry, and to continued innovation and development in the space transportation field.

The US private sector can provide launch service to meet the needs of all space users. It can meet any and all foriegn competition. Private development and operation of launch vehicles can significantly reduce the cost of space transportation. All these things can happen provided that the US Government ceases competing, and threatening to compete, with its own citizens.

Recent statements from launch customers argue that NASA should continue to be in the commercial space transportation business because the private launch industry has failed to emerge in the past few years. The fact is that NASA has undercut the development of private launch service through heavily subsidized operations, and has discouraged existing launch vehicle manufacturers from entering the business. These circumstances have also severely restricted financing for new launch vehicle developers. The results have been disastrous for this country.

The launch needs of the US Government represent a significant part of the market for space transportation services. These launches are a very important source of support for the US private launch industry. The purchase of launch services (instead of launch vehicles) from the US private sector by Government is not a subsidy or a special favor. It is an ordinary purchase of services by the Government. It does not require extraordinary policy changes or special programs. Such purchases would be the most cost-effective and appropriate means of procuring launches for Government needs. Making this market available to the US private sector is also the single most effective means of aiding the private launch industry against subsidized foriegn competition.

The Government role in space transportation should be similar to its role in other transportation areas. It will regulate. It will represent the industry internationally in trade negotiation. It will provide support infrastructure such as launch sites and tracking, just as it provides airports, air traffic control, roads, and traffic lights for other transportation modes. It will support advanced research and development as it does for aviation through NASA.

NASA is chartered as, and should be a research and development organization. The Space Shuttle is useful primarily for specialized missions such as man-tended cargos and large payloads. It is not cost-effective for ordinarily launch use and it should provide launch service only for Shuttle-unique uses. Such use will keep the Shuttles fully occupied for the forseeable life of the fleet under any kind of realistic operating scenario. The Government has no justification for spending large amounts of tax money competing with its own citizens and delaying the emergence of a fully competitive private launch industry.

Statements from some parts of the communications satellite industry attempting to justify continuation of their subsidized launches are nothing more than attempts to get the Government to rescue them from the consequences of their own calculated business judgements. The Shuttle flight rate and cost structure projected by NASA has for years been widely known to be questionable at best. Due diligence would have shown the need to back up Shuttle service with other options. A small fraction of the resources expended would have kept those options available as a "second source." Although national security interests may require the rescue of special parts of this industry, past miscalculations should not be used as justification for continuing its subsidies.

PROPOSED CONGRESSIONAL MEASURES

American Rocket Company recommends that any Congressional action should be based on the assumptions I have just summarized. I would like to offer the following comments on the initiatives under consideration.

The thought of having NASA involved in the Government's procurement of launch services from the private sector, except for some of NASA's own needs, is unwelcome and unhelpful. In many ways it would be worse than the current situation, primarily because competent buyers and competent sellers don't need a middle man. Realistically, much of NASA is hostile to the US launch services industry. So long as NASA has aspirations to remain a commercial space transportation provider it will act as a competitor towards other launch service providers. Only a few years ago NASA was requesting assistance from marketing consultants to help NASA "defeat domestic and foriegn competitors." American Rocket has seen no evidence that this attitude has changed.

Pricing policy for the Space Shuttle is not as important at this time as a use policy. Any pricing policy that remotely reflects the real costs of a Shuttle launch will result in a Shuttle price higher than any competing expendable launch vehicle. Any policy allowing commercial users with payloads flyable on ELV's access to the Shuttle is de facto a policy endorsing massive Shuttle subsidies.

AMROC supports continuation of programs designed to encourage commercial experimentation on the Shuttle, particularly where such experimentation makes good use of the Shuttle's unique capabilities. Programs such as the Joint Endeavor Agreements and the Getaway Specials are an extremely appropriate use of space resources. However, routine launch of payloads that could be carried up on an ELV serve only to perpetuate the current situation.

Returning revenues from sale of Shuttle services to the general fund of the Treasury is an ineffective means of discouraging NASA competition with the private sector. With any honest accounting of Shuttle launch costs, particularly in the post-Challenger environment, there will never be any surplus of funds over launch costs.

I will only briefly comment on the other provisions of the initiative under discussion. Making launch facilities available at direct cost has been a useful step and one which does not burden the taxpayer, and which helps US companies face similar aid given to foriegn competitors by their governments. Encouraging a private, non-mandatory group to provide impartial reviews of launch vehicle reliability is an approach which may prove useful, although such a concept would need to be better defined before AMROC could endorse or reject it. Obviously there is the hazard of such a body becoming a barrier to the entry of new and innovative technologies if it were to come to function as a mandatory regulatory review body.

NEED FOR LEGISLATIVE ACTION

The emergence of a commercial space transportation industry will create new challenges for all branches of Government. Legislative attention will be needed on many of the matters I have touched on here. The most pressing need at this time is for a clear signal from the Government that the emergence of a commercial space transportation industry will not continue to be blocked by the Government. If the Administration does not provide such a signal, Congress must.

Similarly, the most useful thing that could be done by Congress to support the commercial space transportation industry would be policy legislation encouraging the purchase of launch service for Government purposes from the private sector. A NASA role in choosing the launch providers is unnecessary and counterproductive.

The sooner the nation revises its space plans to take the current realities into account, the sooner it can return to planning the future in space that Americans want, expect and deserve. The private space transportation industry is an indispensable part of America's future in space, and the sooner the nation makes the decisions needed to encourage that industry, the sooner the nation can move ahead in space.

I thank you for your attention.

Mr. **Walker**. I thank all of the witnesses very much for their presentations. It has been most useful and helpful to the committee members who are going to move into some of these very policy areas within a matter of not only days, but hours, in reality.

Let me pose a question. I'd just like—I'd like your reaction, because I got the impression from a—a number of you—Mr. Dealy made it quite clear in—in the questioning I did of him earlier, that Government ought to basically back out of the contracts that we have signed with commercial customers, turn that over to the private sector, and move on—move on from there.

The problem is, of course, that in order to do that, as he stated, we owe those people their money back. And just consulting with staff here, that could involve several hundreds of millions of dollars in giving—giving those users back their money.

The question for us is, at the present time, in NASA—and with what we're facing here, that could involve a fairly substantial appropriations that then would come out of the rest of what we are attempting to achieve in space.

Now, is there enough payback to justify—at times of tight circumstances—us making that kind of an investment in—in the future? In other words, the—the investment in the future will essentially be to give people back their money. And—and, you know, how do we justify that to our colleagues who are going to ask, why are you spending $500 million this way at a time when we're trying to find money enough to build a fourth orbiter, for example?

Mr. **Koopman**. I understand the amount involved is more like $200 million. And in any commercial venture, if I take funds for future services, I am required to put them in escrow. I would question why NASA hasn't escrowed those funds since it has not provided those services.

Second, according to even quick calculations, if NASA were to actually provide those services, which it would sell perhaps for a total of—I believe the total contracts involved are about $900 million—that it would cost NASA close to $2 billion to provide those services in terms of what the real launch costs are.

So that by returning the $200 million, which NASA legally should have escrowed, that so far as I would guess that no additional appropriations would be involved—you would be saving the taxpayers over $1 billion.

Mr. **Walker**. Well, and you may be well right, that—that—that that money is held in escrow. I don't know it to be the case, that it's not. And in that case, we would not face the appropriations problem to which I referred—and I think that's a good answer. And I think that that makes—that does make some sense that we are—we are additionally, though, backing out of—of the costs of—of the launch services and so on.

Mr. Dealy.

Mr. **Dealy**. Yeah, let me just add my comment to that. I think Mr. Koopman has expressed the situation very accurately. In the—in the business world if you do accept a deposit from someone, you—even if you don't escrow it, have to put it on your balance sheet as a liability, because you've got to provide at some time the service against that deposit. NASA has not provided these services. It is not a case where they're giving back payments for services that have been performed. So the cost is still ahead of NASA to provide that service.

Since we know that the services were priced at a discount rate, if—if nothing else, they were priced at yesterday's dollars and we are now at tomorrow's costs, there's probably a massive amount of appropriated funds that have to be provided to fulfill those commitments.

The other side of the coin, I think, is that I'm not sure if we would ever once go back and really count who has kept his progress payments up to date—that we're talking about that many cases. And—and I don't want to leave the impression that I'm saying for this industry to get started, one must abrogate existing contracts.

I'm saying face reality—what can the shuttle fly? Post that manifest. Let the people know who will not be flown—right against the most realistic approach that you can come up with, and I think a large portion of this theoretical problem will go away.

Mr. **Walker**. OK. I guess—I guess I'm concerned a little bit about some of the transitions that would—that would be involved in all of that. I mean, I understand what you're saying. I guess I've watched Government bookkeeping a little too long. I mean, if—if Government bookkeeping is done at NASA the way it's done here in Congress, the fact is we probably don't have those liabilities listed that way. I mean, we don't list any liabilities around here and we get ourselves in—in big—in big trouble for it.

But the—but I think—I think you make a—I think you make a good case.

The one thing that I'm reminded by staff here, though, is, if we—if we ended up in some civil suits for damages for breach of contract out of all of this, we could result in awards many times the value of the progress payments. Isn't that a—isn't that a concern in all this?

Mr. **Dealy**. Let me answer that.

Mr. **Walker**. OK.

Mr. **Dealy**. The launch services arrangements that NASA cuts with users provides specifically—at least have always provided—that they have to provide the service by a given date. Or if they are unable to do so within a certain period of time thereafter, the party is permitted to leave the contract and to obtain their money back—is their only best efforts contracts.

That's why I think the issue with abrogation is a red herring. What we're talking about here is the inability of NASA in the current environment to serve these payloads on the timeframes and schedules that were promised. And in addition, we keep on muddying the water up with many, many other launch reservations and numbers that are in reservations as opposed to hard core contracts in which the performance date has passed, or the performance date is still to come.

Mr. **Walker**. Is there general agreement? I mean, is that the understanding of the other witnesses? Mr. Ordahl?

Mr. **Ordahl**. Well, I think there can be a position, and should be a position that in fact that the communications satellite industry—which is one of the main ones that we're talking about here—is a very important industry in this country. After all, they're the satellites that we're trying to launch. And I think virtually all the people in this Nation are touched by the value of those communications satellites that have been put up by that industry, in conjunction with NASA, over 25 years of harmonious work between the Government and that industry to both build and launch those satellites.

That industry has come to rely on the U.S. Government for its launch services. And I think that there can be a position here that the U.S. Government has an obligation to comply with the contracts and commitments that were given through this transition period. And quite frankly, I believe that the Government in fact is in a—could be in a position of supplying those services as fast or faster than any other means possible. And—and so I think there's that side of the equation also.

Mr. WALKER. I am a little confused by that. Mr. Rector?

Mr. RECTOR. I disagree, because I think Dr. Fletcher said yesterday, there's no way they could begin to fly those payloads until the mid-1990's. So, ELV's can start doing it in 1989, and those users, the most important issue which we keep ignoring here, I think we are talking about nits, is the fact that those users, if they stick with the shuttle and these contracts and commitments, but Dr. Fletcher says we won't fly them until the mid-1990's.

They can be flown on ELV's much earlier. The commitment could be made by using ELV's to work off these commitments. That can be done. I think that's what's important the commitments to fly them by a date, not progress payments and those issues. If we turn our backs on them right now because of contracts the shuttle has with those people, you can say goodbye, because the Japanese and the Chinese will be there before the shuttle will be there. And that's what's at stake. We are turning our backs, the United States is turning their backs, on a very important industry that we've helped get there.

Mr. WALKER. I, you know, I—I guess I'm in agreement with that point. I mean, that's—that's my concern is, that we end up having a—a real, really viable domestic industry out of all this. And, you know, I guess my fear is that if we continue to allow NASA to manage it, that we will end up with—with the foreign competitors usurping that which we might be able to do in domestic industry, if we don't find some way to—to do—to do that transition.

Mr. Ordahl, and then I'll turn it back over to the chairman who I see has come back.

Did you get your amendment passed?

Mr. NELSON [presiding]. As usual, the schedule has changed. [Laughter.]

Mr. WALKER. Well, Mr. Ordahl, just one thing that concerned me a little bit in your testimony—you seemed to be indicating at one point that you felt as though the discussions on the lack of commercial use of the shuttle included those things such as the electrophoresis experiments that McDonnell Douglas had been conducting.

My impression is that that has never been a matter of the policies being discussed, that those would be shuttle-unique kinds of loads that would really not affect the electrophoresis. I mean, is there some information that you have that we don't?

Mr. **Ordahl**. No, I don't think so. I think that basically I included that for emphasis. And I—you know, we don't want it to go in the direction I think that would preclude, certainly, the—the application for shuttle-unique kinds of capabilities, such as the EOS system. And—and it was mostly just to ensure and keep that in front of us that we don't cross the line on that issue, also.

Mr. **Walker**. And I gather from the panel that there is a recognition in the commercial industry that that there are certain things the shuttle is going to be doing—able to do because of its manned capacity that are—that are strictly commercial that you want them—you would want them to continue doing because ultimately that—the manned space station may well prove to be another market later on for ELV's. There may be some tie-ins there that will be very, very important to a commercial ELV industry. Is—is that not correct?

Mr. **Koopman**. I think that's precisely correct, sir. The shuttle-unique development of commercial processes will do nothing but help the development of the commercial launch industry. They will provide additional payloads in the future. Currently we see most of the market as communications satellites. There are literally a dozen other major areas that will be developed before the turn of the century in space. And we will look to NASA in its research and development capacity to do that.

I think that you mentioned the space station. I think one of the signals that needs to be sent—and I believe the chairman asked the question yesterday of Dr. Fletcher about resupply of the space station—I think it should be made clear that resupply of the space station, if we're talking about water, and fuel, and cornbeef sandwiches, is an appropriate mission for ELV's. And I heard some waffling on the answer to that question yesterday.

I think it needs to be made clear that it's in fact a direction from this committee that NASA should do all possible things to encourage and off-load payloads to the commercial ELV industry, including space station resupply.

Mr. **Walker**. Raises one interesting question here. Then, has NASA consulted with any of you in the ELV industry with regard to making the space station compatible with possible use for your—with your vehicles?

Mr. **Brackeen**. Mr. Walker, I'd say that there are a lot of speculations and conjectures underway. It's probably a little early for us to ask that they've gotten that act quite together. I think NASA has observed there may be a very viable role for ELV's in the Space Station Program.

I had an offering earlier I wanted to pass along to you. This is perhaps the toughest issue you're facing, we all know, is honoring the existing contracts. I think the reason you have to heed Mr. Dealy's advice and slice the loaf some way, is better understood if you know how we're trying to make our decisions.

While we're doing these deliberations and the many panels are discussing policy, out there in the business world things are happening anyway. And—and many, if not all of those people who hope to fly on the shuttle, are, of course, looking at alternatives. We're all getting inquiries, and we're all responding.

And the rub is this. Those that—that have those contracts—as a matter of fact, I've seen an interesting migration from there being 8, or maybe 16, or maybe 32, or maybe 40, or maybe 90, as people said, well, I really was thinking about perhaps 10. They're unlikely to ever relinquish that unless they have to.

Now, they'll be talking to us about alternatives. Maybe they'll find a way to migrate our launching a satellite that they say wasn't really the one intended.

The point is those prices are so attractive—of course, they couldn't even fly on an Ariane for those today—and so it would be unwise to ask them to relinquish those until they have to.

Now, the very difficult business choice we're making is what population of commercial flights should we count on to amortize our—our investment in this business. We are not asking for the Government to underwrite our investments. We're going to do what businesses do, and that's recover those investments in the price of our commercial product.

The most certain part of the commercial spacecraft marketplace, of course, are represented by those 8, or those 16, or those 30 or 40. And as everyone has testified, as you get out into the mid-1990's it does get considerably softer. Perhaps more realistic prices for traveling to space, perhaps terrestrial alternatives for communication will make it less viable and some of those spacecraft won't get built.

As prudent businessmen, we owe it to our shareholders to do the best job we can in terms of defining that pro forma, that marketplace from which we are going to recover our investments.

So now we have these people unwilling to relinquish those slots until something forces them to—asking us, well, what would the price be? It's hard for us to tell them what the price would be with certainty because we don't really know the size of the market.

It's really a—a quite difficult business problem. And both sectors would benefit from someone stepping up to the decision. I think Mr. Dealy said maybe some decision is better than none. You certainly must define the size of the playing field for us.

Mr. **Walker**. And so that becomes the reason why there was some discussion in the administration about simply saying, shuttle carries no more commercial payloads. I mean you have defined, then, the economics behind making that kind of—of a—of a statement with regard to shuttle. Is that—is that the point?

Mr. **Brackeen**. Yeah. My—my point is unless we were trying to get the Government to—to fund our investments to provide this service, we need to—we need to have a realistic ability to assess how many of these will subsequently fly, or—or that we can subsequently even compete for it, because we're up to the uncertainty of deciding will we or will we not be able to win what fraction from McDonnell Douglas or General Dynamics or Ariane. And believe me, we've put one great deal of effort into that assessment. It's the basic size that we're all competing for that we don't know.

And where I, one of those provider of communications services that had some long-term commitment, I'd be unwilling to relinquish those commitments until I had to.

Mr. **Walker**. Thank you, Mr. Chairman.

Mr. Nelson. Remember the statement that the gentleman from Hughes made yesterday. Let me get your ideas. Who wants to start?

Mr. Rector. I'm not sure which statements you mean but maybe you're referring to the fact that there is no existing, or he doesn't believe that ELV's will survive or be viable competitors and what we need is a world class launch vehicle.

I think we have world class launch vehicles, and we haven't been given a chance to prove that on a commercial basis because of lack of policies and competition with the shuttle, and lack of getting agreements signed. So I don't agree with him that we would not make it. We have not been given the chance to really go out and compete.

So I don't agree with him that we really need a new launch vehicle to go out and do that. I think there are adequate launch vehicles to take care of the current backlog, to solve the problems of which there's something like 80 vehicles that need rides that would not fly on the shuttle until the mid-1990's. There are ELV's to accommodate every one of those. Existing U.S. ELV's. So we don't need a new launch vehicle to do the job.

Mr. Nelson. Do you all agree with that statement?

Mr. Ordahl. Yes, I agree with that.

Mr. Nelson. Does anybody disagree?

Mr. Koopman. I simply want to add that I disagree that we don't have world class launch vehicles. I think all three of these gentlemen here build world class vehicles. When we decided to get——

Mr. Nelson. You are agreeing with his statement?

Mr. Koopman. I am agreeing with his statement. But I disagree with——

Mr. Nelson. OK, does anybody disagree with Mr. Rector's statement?

Mr. Koopman. I simply want to add that the existing world class launch vehicles universally are race cars. They were built originally as military missiles. They were optimized very correctly for performance rather than for low cost. The reason that American Rocket Co. is taking a run at a new launch vehicle is because we believe that what's needed, as someone said yesterday, is pickup trucks. And that we plan to build a truck, one which is optimized for low cost rather than performance.

So I think that we do have launch vehicles that will provide rides for all those COMSAT's; that what's needed simply is for the U.S. Government in effect to get out of the way.

Mr. Nelson. OK. By you all agreeing to—or agreeing to disagree with the Hughes statement, then, from yesterday, does this mean that if your company were awarded the NASA ELV contract to work off the Government payloads that are backlogged, and so now you—your company is providing launch services to NASA under this initiative that we're talking about. Then the question is, Could you make it financially in the commercial ELV market competing with the Ariane, competing with ultimately the Japanese vehicle, and any other vehicle?

Mr. Brackeen. I'll start with that. We've been to that very similar analysis, of course, in the context of the MLV competition. And so in presuming that what you have in mind is analogous, I would say, yes, then I would think all three of these launch vehicles could—but they should speak for themselves.

You see, the main thing we—we would like is to understand the size of that commercial market. It's—it's a little muddy if there begins to be some Government funding of the development or nonrecurring that flows as a result of that award you're talking about. But in general I—that's the—that's the context with which the DOD has—has written the solicitation for the MLV. And I'm sure that all of our teams are busy at home responding favorably to that, so we have to answer yes.

Of course, the issue will be at what price? Because no private manufacturer will offer the product at less than his cost. And I—I'll speak for—in our case, as we look at competition with the Ariane, we frankly give them all we think they can build and launch.

As to competition with the Chinese or competition offered, for instance, by the protan, we think that's unrealistic for any reasonable length of the future considerations for American-built satellites. As regards the H2 launch vehicle, we think that will be a factor in the future, but sometime in the future.

So should we be awarded the MLV contract, we—we will vigorously pursue commercial business. Should we be awarded a contract under similar context for NASA, we certainly would also. We would guess that with those business bases, because, of course, we're pricing new Titans to the DOD as we speak, and we know what we'll be selling them for, given our sizable production base.

We would guess that the prices that would be available would not be widely disparate with what's being quoted by Ariane for future prices today. So you're asking me to speculate and I wanted to define the terms of the speculation.

Mr. Rector. I'd like to add to that because there's a few things I didn't understand yesterday in Dr. Fletcher's testimony about the need for only a couple Deltas and a couple Titans. We've analyzed the shuttle manifest, pre-*Challenger* manifest, and did our analysis based upon the 2-year down time and recovery. How many vehicles would be flown with the shuttle? Our data shows out of the 78 flights that had been planned for the 4 years in the shuttle manifest, there's 103 payloads. About 80 of them are unique shuttle payloads, like Spacelab, Hubble telescope, and uniquely required DOD payloads.

So we set some priorities, and out of that there was 100 that could go on an ELV. But some of those would have priorities to go on the shuttle. So we ended up in our analysis, on a priority basis, that there would be about 82 payloads with a 2-year down time that would not have rides until the 1990's. And of those 82 payloads, 32 of them are Government payloads, such as GPS, which we've heard about, and other civilian payloads. And 50 of them are commercial or foreign.

Now, already 17 of those have gone to the Ariane. So we've already decreased that 50 by about 17. So these once again, can be flown on today's ELV's. So there's a significant market, both Government and commercial, for us to go out and compete for and fly at much earlier dates than the shuttle.

Mr. NELSON. OK. That's at variance with what we heard from one of the witnesses yesterday, who was minimizing the market, saying that there were only—if I recall, wasn't it 4 to 8 payloads? Or was it 8 to 12 payloads, per year?

Mr. RECTOR. I think the number was a little higher than that. Most of the market analysis that everybody's been dealing with is like 15 to 16 commercial payloads per year, on the average.

So this is a 4-year manifest. If you divide the 50 I took, well, that's commercial and foreign. There's 34 commercial payloads in that 4-year manifest. That's NASA's manifest, so those are real bookings, or real earnest moneys, or at least they're on the manifest. So that's 34 over 4 years.

And then you add to that what Ariane has. So the number of 15 to 16 commercial communications satellites is about right.

Mr. NELSON. Well, you're saying there are 34 over 4 years.

Mr. RECTOR. That's what was in the manifest, that were commercial——

Mr. NELSON. Uh-huh. Maybe that's what they were referring to.

Mr. RECTOR. Yes.

Mr. NELSON. A little over eight per year, then.

Mr. RECTOR. Yeah, about nine per year in there, and that's just on the shuttle manifest. That's not the Ariane manifest.

Mr. KOOPMAN. And I'd like to emphasize, Mr. Chairman, that there are numerous payloads that are not counted here in anybody's counts. I am not privy to General Dynamics' analysis, but I saw some of the results published elsewhere. There are a number of commercial companies currently building payloads or contemplating building payloads that were never manifested on the shuttle.

There are a number of organizations, some of whom have been negotiating with NASA for years trying to get JEA's that would pay to fly commercially under the right circumstances.

There are foreign payloads that are not manifested, so——

Mr. NELSON. Excuse me just a minute.

Mr. KOOPMAN. Yes, sir.

[Pause.]

Mr. NELSON. Well, we're going to breach custom here, and I'm going to have the staff continue the questions because they say my amendment is up. As you can see, they've changed the schedule again.

All right, the staff will submit them in writing. Do you want to recess just a minute and see if you can get another member of the committee to come on in and continue?

The committee will stand in recess.

[Recess.]

Mr. CLEMENT. Off the record, please.

[Off the record.]

Mr. CLEMENT. The staff will submit questions in writing, if you would please respond to them. The committee is adjourned, unfortunately, there are no members available. Thank you.

Mr. RECTOR. Are we adjourning?

Mr. CLEMENT. We are adjourned. The confusion factor is high in the last week before a recess.

[Whereupon, at 4:10 p.m., the subcommittee was adjourned.]

Assured Access to Space

QUESTION 1:

In terms of Space Shuttle-equivalent cargo bays full of payloads prior to the accident:

a. what was the projected launch demands each year through 1990?

b. given this launch demand, how many Shuttle-equivalents each year were scheduled to fly on ELVs?

ANSWER 1:

a. The Shuttle flight manifest before STS 51-L shown below basically supported the Shuttle launch demand. The opportunity line indicated excess capability.

	FY 86	FY 87	FY 88	FY 89	FY 90	TOTAL
COMMERCIAL	4.8	1.9	2.6	5.3	5.2	19.8
DOD	3.0	5.7	9.3	9.8	8.4	36.2
NASA	6.2	8.7	6.1	7.3	9.5	38.8
OPPORTUNITY		.7	---	1.6	.9	3.2
FLIGHTS	14	17	18	24	24	97

*Communication satellites plus German and Japanese Spacelab, Space Industries Inc., and Geostar.

b. The Expendable Launch Vehicle (ELV) schedule before STS 51L is shown below, by number of launches for each vehicle, by fiscal year through 1990. Each Atlas Centaur launch is equal to 1/2 Shuttle equivalent; DELTA, Scout, and Atlas E/F's are equivalent to 1/4 Shuttle.

VEHICLE	FY86	FY87	FY88	FY89	FY90	TOTAL
Scout	2	4	2	2	2	12
DELTA	2	2	-	-	-	4
Atlas/Centaur	1	2	-	-	-	3
Atlas E/F	1	1	1	1	1	5
FLIGHTS	6	9	3	3	3	24

QUESTION 2:

Of those payloads scheduled to fly on the Space Shuttle:

a. What percentage could be readily moved to ELV's at little additional expense?

b. What percentage could be moved to ELVs at some moderate level of expense?

c. What percentage are "Shuttle-dependent" because they require man or they would be too expensive to move to ELVs? (Note: the sum of these three percentages should equal 100 percent).

ANSWER 2:

a., b. It is not possible to determine at this time the relative costs to transfer Shuttle payloads to ELVs; however, thru FY 92 approximately 100 out of 230 payloads (43%) could be flown on ELVs, if they were available. There would be some additional costs to the spacecraft, and possible significant cost to modify the current ELV systems to accommodate these spacecraft. Also, NASA's Delta and Atlas Centaur vehicles, which would accommodate most of these payloads, are virtually out of production. New production of these vehicles would require 24 to 36 months from contract go-ahead, before new deliveries could begin. The payloads which could fly on ELV's include all foreign and commercial communication satellites, DOD GPS and other DOD payloads, and other U. S. Government (NOAA, Landsat, GOES, Lageos, etc.,) This includes about 7% of the NASA payloads, 88% of the commercial/reimbursable payloads, and 71% of the DOD shared and dedicated payloads.

c. Thus, approximately 130 out of 230 Shuttle payloads (57%) of the payloads are Shuttle dependent or would be too expensive to move to ELVs.

QUESTION 3:

If no ELVs in addition to those approved for use prior to the accident are employed, what will be the likely size of the "backlog" (in STS equivalents) of unlaunched payloads by the end of 1989?

ANSWER 3:

If no additional ELVs are approved, the likely size of the STS backlog of unlaunched payloads by the end of FY 89 is 33 equivalent Shuttle flights. This assumes a 12-month standdown.

QUESTION 4:

When could a replacement Orbiter be delivered?

ANSWER 4:

It is estimated that a replacement Orbiter could be delivered in thirty-six to forty-two months from authority to proceed. This estimate assumes availability of funding, the use of logistics inventory as required, and using the structural spares.

QUESTION 5:

Won't the use of "operating spares" to build an Orbiter have a bad effect on the turnaround time required to overhaul an Orbiter after each flight?

ANSWER 5:

The flight schedule will always have priority on any component or Line Replaceable Unit (LRU) in the replacement Orbiter program. On isolated cases such as a component failure late in a count-down where the component's spare had been borrowed for the replacement Orbiter, a delay caused by sending the part from Palmdale to KSC could occur. It is anticipated that this will be rare and the benefits outweigh the "bad effects".

QUESTION 5:

a. To what extent does this delivery date assume the use of spare parts and engines that were originally purchased to service Orbiters after each flight?

b. Won't these parts have to be replaced?

c. How long would that take?

ANSWER 5:

a., b. The schedule for building a replacement Orbiter requires borrowing assets from the logistics program on the occasion when a point in the "Build and Flow" Plan is reached and the "new" part has yet to be delivered. At this point in the build and flow of the Orbiter, the part would be borrowed from logistics and then repaid to logistics when the "new" part is delivered. This approach allows for an accelerated and efficient build. New engines will be used on the replacement Orbiter and will not be used from engine spares. Regardless of production requirements, the launch program will always have priority over the production program.

Yes, these parts will have to be replaced.

c. Approximately 80 per cent of the borrowed spares could be replaced within 20 months. To replace the longest lead item that could be borrowed from logistics to use on the replacement Orbiter would take about 3 years from authority to proceed.

QUESTION 6:

a. What would be the cost of a replacement Orbiter?

b. What would be the cost of replacing the "operating spares" used to build the replacement Orbiter?

ANSWER 6:

a. A replacement Orbiter with three engines and support equipment is estimated to cost approximately $2.8 billion. This value is based on a mid-FY 1986 start with a 42-month build schedule and includes a replacement set of structural spares ($450M).

ANSWER 6:

b. The total cost for replacing "borrowed operating spares" cost is included in the estimate for the Orbiter.

QUESTION 7:

a. Do you believe that the "structural spares" used to build a replacement Orbiter should be rebuilt?

b. Why?

c. How much would that cost?

ANSWER 7:

a. Yes.

b. The structural spares should be rebuilt for two reasons. First, since the Space Shuttle system is key to the Nation's launch capability, launch assurance can only be provided by taking the appropriate steps to reduce the time to perform major repair or replacement of an Orbiter. This was the original basis for building a set of structural spares and this rationale remains valid.

Secondly, there are still uncertainties regarding the launch rate requirements in the mid-1990's. These may require additional launch capability and additional Orbiters. Since the major subcontractor manufacturing capability will erode upon delivery of the current structural spares and will severely effect future delivery of structural components, the structural spares should be replaced.

c. The estimate to replace the structural spares is $450 million.

QUESTION 8:

If a replacement Orbiter is not purchased, what would be the likely programmatic impacts of a three-Orbiter fleet on each of the following?

a. The Space Station program?

b. Other civil programs?

ANSWER 8:

a. If a replacement Orbiter is not purchased, it would be possible to assemble and sustain the Space Station with a three-Orbiter fleet.

b. Use of the Shuttle for other programs would be significantly restricted, however.

QUESTION 9:

Over the long term with what frequency will an Orbiter have to be rotated out of service for long term overhaul and maintenance?

What would be the likely "downtime" required to make the necessary repairs?

ANSWER 9:

NASA has studied the inspection, maintenance, and overhaul requirements for the Orbiter. The subsystem components are verified by the between flight test and verification programs. Inspection of the structural elements have been scheduled individually and are performed as required during the Orbiter processing schedule.

With the continuous Orbiter inspection and maintenance between flights, special inspection and overhaul is not anticipated to be required on a scheduled basis, and would only be required in the event of an anomaly or unanticipated requirement. The resulting downtime for this type activity would be totally dependent on the specific circumstances.

QUESTION 10:

If an Orbiter were to damage a landing gear or wing tip during a landing, what might be the "downtime" required to make the necessary repairs?

ANSWER 10:

The time required to repair a damaged Orbiter if a landing gear or wing tip were damaged during landing would be a function of the extent of damage. Minimal damage to a wing tip could be repaired in about three months; extensive damage caused by a collapsed landing gear could require replacement of the entire Orbiter structure which could require 3 to 5 years, depending on the availability of a set of structural spares.

QUESTION 11:

If Challenger were not replaced by another Orbiter, what would be the impact of the extended unavailability or total loss of a remaining Orbiter on each of the following:

a. Space Station program?

b. Other civil programs?

ANSWER 11:

If the Challenger is not replaced, the impact of a loss of one of the remaining Orbiters is as follows:

a. Space Station Program--Although the Space Station is not yet fully defined, preliminary estimates show that if Challenger was not replaced, the impact on Space Station of an Orbiter being out of service, or lost, would be extremely severe. Once operational, the Space Station will require approximately 8 - 11 Shuttle flights per year for both logistics and payloads. If Challenger was not replaced and an existing Orbiter was out of service, a two-Orbiter fleet could sustain the Space Station and, theoretically, meet these requirements; however, the transportation system would be unwisely stressed. Prudence would then require Space Station operations to be cut back significantly.

b. This results in the loss of approximately 6 additional equivalent Shuttle flights of civil payloads per year.

QUESTION 12:

Throughout at least the mid 1990s, how many Orbiters will be required to service the needs of all Shuttle-dependent payloads?

ANSWER 12:

The Administration is currently examining this issue and is expected to complete its findings shortly. Under the conditions that existed pre-accident, four Orbiters were judged to be appropriate to meet the Shuttle demand by all sectors. Under the same conditions, three Orbiters would appear to be insufficient. However, the Administration is reviewing a wide range of factors affecting the Shuttle capacity to service Shuttle-dependent payloads, including possible off-loading of some non Shuttle-dependent payloads to ELV's, and more conservative assumptions about Shuttle flight rates and effects of Orbiter down-time. In particular, the Space Station would continue to place a heavy demand on Shuttle capacity in the mid-1990's.

QUESTION 13:

Is there any reasonable way that Orbiters alone would be capable of servicing the "backlog" of unlaunched payloads that will have accumulated by 1990?

ANSWER 13:

If a fourth Orbiter would be produced and operational by FY 1990, the total backlog without shifting any payloads to ELV's can not be accommodated. Specific DOD and Space Station requirements could be accommodated with priorities over other requirements.

QUESTION 14:

What is the current status of each ELV production line in the U.S. that is of any potential interest to your agency?

ANSWER 14:

The current status of each Expendable Launch Vehicle (ELV) production line is as follows:

Vehicle System	Production Status
Scout -	All 12 vehicles planned for launch are in inventory. Production of additional Scout vehicles would require 24 months lead time of contractual authority to proceed.
Delta -	All four vehicles planned for launch are in inventory. Three additional vehicles are partially completed but no work is being done on these vehicles since a stop-work decision in mid-1984. Additional long lead material available for 8 vehicles which could be used if production go ahead is made. Up to 24 months would be required to re-establish production and launch of new vehicles.
Atlas Centaur -	Three vehicles remain to be launched by Atlas Centaur. Two vehicles in inventory and one virtually completed but not yet delivered. New production to re-establish a production line and new deliveries would require 30 to 36 months of contractor go ahead.
Titan Family -	Vehicles being produced for DOD missions. This capability could best be addressed by the DOD

QUESTION 15:

When is the earliest that a stream of new vehicles could begin flowing off of each of these production lines?

ANSWER 15:

(See answer in #14 to this question.)

QUESTION 16:

What would be the cost of reactivating or expanding the production capability of each of these ELV lines?

ANSWER 16:

NASA's Expendable Launch Vehicle Systems consist of Scout, Delta and Atlas Centaur. These vehicle systems are virtually out of production. Vehicles still in inventory are planned for firm dedicated missions which will be launched before the end of this decade. To restart production, manufacture and launch these vehicles at a steady-state rate of four vehicles per year, it has been estimated that the following investment would be necessary:

Vehicle System	Start-up Cost	Hardware Unit Cost	Launch Cost (Contractor Only)*
Scout	2.5M	6.0M	2.0M
Delta (3920)	30.0M	28.0M	8.0M
Atlas Centaur	36.0M	65.0M	9.0M

The Titan family of launch vehicles is maintained and operated by the Department of Defense. The Titan II vehicles are ballistic missiles being converted to space launch boosters. The Titan III CELV is under development with first launch capability in 1988. Cost data for these systems, as well as the Atlas E/F system, should be requested from the DOD.

*Cost does not include NASA program management, recovery of prior investments and facility rentals, USAF range costs or tracking and other program support.

QUESTION 17:

What is the approximate unit cost of the vehicles that will flow off these production lines?

ANSWER 17:

See answer to #16.

QUESTION 18:

Given the launch priority of the Defense Department;

a. if the U.S. government were to decide not to buy or use any additional ELVs, what percentage of the total Space Shuttle launch capability would be needed by the Defense Department for national security payloads?

b. What would be the impact of this high DOD utilization of the Space Shuttle on each of the following?

--The Space Station Program?
--Other government programs?
--Commercial program?

ANSWER 18:

a. If the U.S. Government decided not to use or buy additional ELV's, the Defense Department would require 50 per cent of a three Orbiter fleet, or 33 per cent of a four-Orbiter fleet capability.

b. Although not yet fully defined, preliminary estimates show that once the Space Station is operational, some 8-11 Orbiter flights per year will be necessary for Space Station logistics and payloads. Any national launch priority that limits the availability of Orbiters could have a significant impact on our ability to meet these requirements.

Commercial payloads, sponsored by the Office of Commercial Programs, require flight on the Space Shuttle. Several commercial experiments were scheduled to fly on the Shuttle this year. In addition, a number of other experiments have been approved for flight but not manifested. Formal requests for 22 flight opportunities over the next 5 years (1987-1991) have been made for these payloads. In addition, although no formal requests for flight assignments have yet been made, 9 companies have indicated an aggregated requirement for over 100 flight opportunities to support their anticipated commercial space related R&D efforts over the next 10 years. Of these companies, 4 have agreements in force requiring over 30 flight opportunities over the next 5 years. It must be recognized that these payloads are mostly secondary type payloads.

Further, several centers for the commercial development of space have defined requirements for flight experiments beginning as early as 1987.

Thus, we anticipate requiring flight opportunities for these experiments of approximately 1 per mission at a flight rate of 10-15 flights per year to enable the effects of the Challenger loss to be minimized and enable the commercial development of the space program to continue as before the accident. However, any factor which reduces the number of flight oppportunities -- including high DOD utilization rates -- would affect the ability to conduct commercial development of space activities.

QUESTION 19:

How many ELVs of each type do you believe should be employed each year by NASA or other civil users to help dispose of the "backlog" of unlaunched payloads that will exist by the end of 1989?

--CELVs?
--Titan 34Ds?
--Atlas-Centaurs?
--Titan 11/Thor-Delta class?

ANSWER 19:

Assuming the family of vehicles were given immediate go ahead, and the first launch is available in late 1988/early 1989, then for the Titan II/Thor Delta and Atlas Centaur classes of vehicles, it is believed that a steady rate of 3 to 4 per year could provide a viable program for either a commercial or government operator. With this launch rate, a fairly economical reliable program could be maintained. Any launches beyond this rate would of course increase the efficiency until that particular system became launch pad or factory manufacturing limited.

For the larger vehicles, like CELV's, two per year would provide the same program characteristics.

QUESTION 20:

How would the availability of these ELV's impact the desire to maintain assured access to space throughout the 1990's?

ANSWER 20:

An ELV capability, in conjunction with the STS, would enhance mission users flexibility and provide greater confidence of assured access to space throughout the 1990's.

QUESTION 21:

For those vehicles (e.g., Thor-Delta) for which the commercial supplier is someone other than the manufacturer, do you believe the government should buy the ELVs through the supplier or directly from the manufacturer?

ANSWER 21:

If either the commercial entrepreneur or the manufacturer were responsive to the agencies requirements and had equal funds, demonstrated similiar technical and management capability, and were competitively priced, it would make little difference from whom the government buys the ELVs.

QUESTION 22:

What effect do you believe government use of ELV's would have on the commercial viability of such vehicles as a competitor to the Ariane on the world market?

ANSWER 22:

As with the Ariane, the government use of a commercial vehicles would increase its viability through potential realization of economies due to large production and launch rate, and possibly increased confidence from a government supplier.

QUESTION 23:

Please provide a summary table that compares for each year, from now through 1992, the overall payload demand (in STS equvalents) that had been scheduled or planned to be flown versus the likely availability of Space Shuttle and ELV launch capacity. (Please assume a one-year downtime for the Shuttle fleet and the availability of a replacement Orbiter in 4 years).

ANSWER 23:

PAYLOAD DEMAND VS LAUNCH CAPABILITY
(EQUIVALENT SHUTTLE FLIGHTS)

	FY86	FY87	FY88	FY89	FY90	FY91	FY92	TOTAL
PAYLOAD DEMAND								
(STS)	9.0	17.0	18.0	24.0	24.0	24.0	24.0	140.0
(ELVs)	1.5	4.2	2.2	3.0	3.2	3.1	2.3	19.5
LAUNCH CAPABILITY								
(STS)	.	6.0	14.0	15.0	22.0	24.0	24.0	105.0
(ELVs)	1.5	4.8	3.2	10.4	10.1	10.0	9.2	49.2

MR. ALDRIDGE'S RESPONSE TO WRITTEN QUESTIONS

ASSURED ACCESS TO SPACE - APPENDIX #2

House Cmte on Science & Tech			INSERT FOR THE RECORD					
☐	HOUSE SENATE	APPROPRIATIONS COMMITTEE	☐	HOUSE SENATE	ARMED SERVICES COMMITTEE	☐	HOUSE SENATE	OTHER
HEARING DATE 26 Feb 86	TRANSCRIPT PAGE NO. P1		LINE NO. Q1a-b		INSERT NO. HST-1			

LAUNCH DEMAND THROUGH 1990

Question: In terms of Space Shuttle-equivalent cargo bays full of payloads, prior to the accident, what was the projected launch demands each year through 1990? Given this launch demand, how many Shuttle-equivalents each year were scheduled to fly on the Space Shuttle and how many were scheduled to fly on ELVs?

Answer: In terms of Shuttle-equivalent cargo bays the projected DOD Shuttle payload demand prior to the Challenger loss was 3.0 in FY 86, 6.0 in FY 87, 8.5 in FY 88, 9.7 in FY 89 and 9.0 in FY 90.

In terms of Shuttle-equivalent cargo bays the projected DOD expendable launch vehicle payload demand prior to the Challenger loss was approximately 6.9 in FY 86, 3.6 in FY 87, 2.2 in FY 88, 3.2 in FY 89 and 3.0 in FY 90. The data is approximate since several ELV payloads are not Shuttle-compatible. Rough Shuttle bay equivalents had to be used in some cases.

House Cmte on Science & Tech	INSERT FOR THE RECORD			
☐ HOUSE ☐ SENATE	APPROPRIATIONS COMMITTEE	☐ HOUSE ☐ SENATE	ARMED SERVICES COMMITTEE	☐ HOUSE ☐ SENATE OTHER
HEARING DATE 26 Feb 86	TRANSCRIPT PAGE NO. P1	LINE NO. Q2a-c	INSERT NO. HST-2	

SPACE SHUTTLE/ELV PAYLOADS

Question: Of those payloads scheduled to fly on the Space Shuttle: What percentage could be readily moved to ELVs at little additional expense? What percentage could be moved to ELVs at some moderate level of expense? What percentage are "Shuttle-dependent" because they require man or they would be too expensive to move to ELVs? (Note: The sum of these three percentages should equal 100 %.)

Answer: Although providing the ability to move critical DOD Shuttle payloads to ELVs will create additional near term program expense, it provides the only means of insuring the availability of critical space based resources. About 25% could be transferred at relatively low expense; 50% at relatively moderate expense, and about 25% are impractical or very costly to move to ELVs.

House Cmte on Science & Tech **INSERT FOR THE RECORD**

☐	HOUSE SENATE	APPROPRIATIONS COMMITTEE	☐	HOUSE SENATE	ARMED SERVICES COMMITTEE	☐	HOUSE SENATE	OTHER
HEARING DATE 26 Feb 86		TRANSCRIPT PAGE NO. P1	LINE NO. Q3		INSERT NO. HST-3			

BACKLOAD OF UNLAUNCHED PAYLOADS

Question: If no ELVs in addition to those approved for use prior to the accident are employed, what will be the likely size of the "backlog" (in STS equivalents) of unlaunched payloads by the end of 1989?

Answer: Assuming no new ELVs, a 12 month Shuttle standdown, a conservative Shuttle flight rate and the continued existence of planned DOD/NASA payloads, the approximate size of the "backlog" would be 30 in Shuttle-equivalent cargo bays by the end of FY89.

House Cmte on Science & Tech **INSERT FOR THE RECORD**

☐ HOUSE ☐ SENATE	APPROPRIATIONS COMMITTEE	☐ HOUSE ☐ SENATE	ARMED SERVICES COMMITTEE	☐ HOUSE ☐ SENATE	OTHER

HEARING DATE	TRANSCRIPT PAGE NO.	LINE NO.	INSERT NO.	
26 Feb 86	P1	Q4a-b	HST-4	

STRUCTURAL SPARES

Question: Do you believe that the "structural spares" used to build a replacement Orbiter should be rebuilt? Why?

Answer: Yes. The construction of a replacement orbiter does not guarantee that in the future an orbiter would not again be lost or severely damaged. Prior to shutting down orbiter production capability, a set of structural spares, in addition to the fleet of orbiters, should be produced as a hedge against potential future problems.

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☒ HOUSE ☐ SENATE	APPROPRIATIONS COMMITTEE	☐ HOUSE ☐ SENATE	ARMED SERVICES COMMITTEE	☐ HOUSE ☐ SENATE	OTHER	
HEARING DATE 26 Feb 86	TRANSCRIPT PAGE NO. P1	LINE NO. Q5 a-b	INSERT NO. HST-5			

THREE ORBITER FLEET

Question: If a replacement Orbiter is not purchased, what would be the likely programmatic impacts of a three Orbiter fleet on each of the following: National Security Programs? Civil Programs?

Answer: The programmatic impacts to the Nation of a three orbiter fleet would be significant. Assuming no additional Shuttle standdowns (unlikely) and resumption of flights within 12 months, the DOD will use a large percentage of available flights. In fact, if predictions that a three orbiter fleet would only be capable of no more than 12 to 15 flights per year are true, the DOD would almost be the exclusive user of the Shuttle and a large growing backlog or offload of NASA, foreign and commercial payloads would develop. This would force both DOD and NASA to acquire many more expendable launch vehicles to meet user needs. In addition, the possibility that one of the three orbiters could be grounded leaving only a two orbiter fleet would further jeopardize our access to space as a Nation.

House Cmte on Science & Tech INSERT FOR THE RECORD

☐	HOUSE	APPROPRIATIONS COMMITTEE	☐	HOUSE	ARMED SERVICES COMMITTEE	☐	HOUSE	OTHER
☐	SENATE		☐	SENATE		☐	SENATE	
HEARING DATE 26 Feb 86		TRANSCRIPT PAGE NO. P1	LINE NO. Q6 a-b		INSERT NO. HST-6			

REPLACEMENT FOR CHALLENGER

Questions: If Challenger were not replaced by another orbiter, what would be the impact of the extended unavailability or total loss of a remaining orbiter on each of the following: National security programs? Civil programs?

Answer: Without a significant number of additional ELVs, the impact to the Nation of only having a two orbiter Shuttle fleet for any significant length of time could be disastrous. The pre-accident equivalent Shuttle bay DOD Shuttle flight rate built to a minimum of 9.7 in FY 89. When backlogged civil, foreign, commercial and military payloads are considered, even with exclusive use of the remaining orbiters, DOD's needs would probably not be met. Virtually all civil, foreign, and commercial flights would likely be cancelled or offloaded to ELVs. Relying on two orbiters would represent an intolerable situation, not only for DOD but for the Nation as a whole; consequently, many additional expendable launch vehicles would have to be acquired on an emergency basis, if an additional orbiter were lost.

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☒ HOUSE ☐ SENATE	APPROPRIATIONS COMMITTEE	☐ HOUSE ☐ SENATE	ARMED SERVICES COMMITTEE	☐ HOUSE ☐ SENATE	OTHER
HEARING DATE 26 Feb 86	TRANSCRIPT PAGE NO. P1	LINE NO. Q7	INSERT NO. HST-7		

NUMBER OF ORBITERS REQUIRED

Question: Throughout at least the mid 1990s, how many Orbiters will be required to service the needs of all Shuttle-dependent payloads?

Answer: In terms of Shuttle-equivalent cargo bays, the projected DOD Shuttle payload demand prior to the Challenger loss was 3.0 in FY 86, 6.0 in FY 87, 8.5 in FY 88, 9.7 in FY 89 and 9.0 in FY 90. However, not all of the projected DOD demand is Shuttle-dependent (must involve man or be returned to earth). Most of the DOD Shuttle-dependent payloads consist of SDI related experiments. They average 1.6 Shuttle equivalent flights per year through the mid 1990s and one orbiter could meet the need. The remaining payloads could be launched on expendable launch vehicles (ELVs) but redesigning all satellites for ELVs would be expensive, time-consuming and would ignore the large national investment made in the Shuttle. The balanced fleet concept, using the Shuttle and ELVs, will provide a robust industrial base and launch alternatives which will be viable throughout the 1990's.

House Cmte on Science & Tech		INSERT FOR THE RECORD					
☐	HOUSE SENATE	APPROPRIATIONS COMMITTEE	☐	HOUSE SENATE	ARMED SERVICES COMMITTEE	☐ HOUSE SENATE	OTHER
HEARING DATE 26 Feb 86		TRANSCRIPT PAGE NO. P1	LINE NO. Q8		INSERT NO. HST-8		

ACCUMULATED ORBITER BACKLOGS

Question: Is there any reasonable way that orbiters alone would be capable of servicing the "backlog" of unlaunched payloads that will have accumulated by 1990?

Answer: No. Without additional Shuttle launch facilities at KSC, buying additional orbiters could not service the "backlog" of accumulated unlaunched payloads. In addition, exclusive dependence on additional orbiters would leave us in the same vulnerable posture we are today. Another unforeseen Shuttle loss or standdown without a mixed fleet of Shuttle and ELVs to provide assured access to space could be disasterous for both the DOD and civil space programs.

INSERT FOR THE RECORD

☒	HOUSE	APPROPRIATIONS COMMITTEE	☐	HOUSE	ARMED SERVICES COMMITTEE	☐	HOUSE	OTHER
☐	SENATE		☐	SENATE		☐	SENATE	

HEARING DATE 26 Feb 86	TRANSCRIPT PAGE NO. P2	LINE NO. Q9	INSERT NO. HST-9	

CURRENT STATUS OF ELV PRODUCTION LINE

Question: What is the current status of each ELV production line in the U.S. that is of any potential interest to your agency?

Answer: Four existing expendable launch vehicle (ELV) production lines are of interest to the DOD: Titan, Atlas, Delta and Scout. Some limited current activity continues; however, several booster lines may close. The Titan production line at Martin Marietta Aerospace in Denver, Colorado has the major share of ELV production activity in this country today. The final Titan 34D booster is in assembly at the factory, but procurement of ten Complementary ELVs began in FY 86. Additional activity for modification of 13 Titan II missiles will keep the production line open.

The Atlas production line at General Dynamics Convair Division in San Diego, California is currently building two new Atlas-G/Centaur boosters and modifying eight surplus Atlas-E ICBMs. Procurement of fourteen Centaur upper stages for the Space Shuttle and CELV also provides activity for the production line and personnel.

The Delta launch vehicle production line of McDonnell Douglas Astronautics Company in Huntington Beach, California, continues with assembly of two boosters. Plant facilities and personnel are also being employed in production of payload fairings for the CELV program. Possibilities for resuming booster production for DOD, NASA and commercial requirements have been investigated.

The Scout production line at LTV Corporation, Vought Missiles and Advanced Programs Division, in Dallas, Texas continues with production of the final vehicle. Current DOD plans include procurement of two more boosters to support out-year user needs, so the line will continue in the near future.

House Cmte on Science & Tech	INSERT FOR THE RECORD						
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HEARING DATE 26 Feb 86	TRANSCRIPT PAGE NO. P2	LINE NO. Q10	INSERT NO. HST-10				

EARLIEST ELV PRODUCTION

Question: When is the earliest that a stream of new vehicles could begin flowing off of each of these production lines?

Answer: As part of our analysis of impacts to the DOD space program by the loss of Challenger, we examined lead times for procurement of new expendable launch vehicles.

The current procurement programs for the Complementary ELV and the modified Titan II cannot be accelerated to any significant extent. Initial availability is October 1988 for the CELV and April 1988 for the first Titan II booster.

New build of existing Titan designs, such as the 34D would require about 24 months. Procurement of Atlas launch vehicles would take advantage of existing spare parts. Contractor first-look estimates are a 24 month lead time for the first booster. The Delta program could also utilize existing spares and lead time for a new booster is roughly 18 to 20 months. Additional Scout boosters require about 24 months lead time.

House Cmte on Science & Tech

INSERT FOR THE RECORD

☐	HOUSE	APPROPRIATIONS COMMITTEE	☐	HOUSE	ARMED SERVICES COMMITTEE	☐	HOUSE	OTHER
☐	SENATE		☐	SENATE		☐	SENATE	

HEARING DATE	TRANSCRIPT PAGE NO.	LINE NO.	INSERT NO.	
26 Feb 86	P2	Q11	HST-11	

COST OF ELV PRODUCTION LINES

Question: What would be the cost of reactivating or expanding the production capability of each of these ELV lines?

Answer: Since each of these ELV production lines are engaged in some form of activity, no significant reactivation costs would be incurred, but each line has a unique inherent limitation in annual capacity. Expanding production beyond these limits would require additional tooling and personnel. Costs associated with each type of vehicle are not now available, but this will be one area examined as our plans on alternatives are refined.

House Cmte on Science & Tech

INSERT FOR THE RECORD

☐ HOUSE ☐ SENATE	APPROPRIATIONS COMMITTEE	☐ HOUSE ☐ SENATE	ARMED SERVICES COMMITTEE	☐ HOUSE ☐ SENATE	OTHER
HEARING DATE 26 Feb 86	TRANSCRIPT PAGE NO. P2	LINE NO. Q12	INSERT NO. HST-12		

UNIT COST OF ELV

Question: What is the approximate unit cost of the vehicles that will flow off these production lines?

Answer: In our ongoing analysis of alternatives, one key criterion is cost effectiveness. In coordination with the manufacturers, a rough comparison of costs can be made. These cost estimates have not been examined in detail and are based on several assumptions, including launch rate, launch teams in-place and upgrade of the Titan II/Atlas/Delta class vehicle to carry the Global Positioning System Satellite. Modifications would have a one-time design cost, which varies with the specific launch vehicle.

The cost of these vehicles ranges from $35-55 million for a medium class booster to $70-75 million for the heavier capability Titan 34D class launch vehicles. Exact estimates would be subject to competition among alternatives, where applicable, and contract negotiations for future procurement.

We will continue to refine these figures and examine the program assumptions.

House Cmte on Science & Tech	INSERT FOR THE RECORD				
☐ HOUSE ☐ SENATE	APPROPRIATIONS COMMITTEE	☐ HOUSE ☐ SENATE	ARMED SERVICES COMMITTEE	☐ HOUSE ☐ SENATE	OTHER
HEARING DATE 26 Feb 86	TRANSCRIPT PAGE NO. P2	LINE NO. Q13 a-b	INSERT NO. HST-13		

DOD UTILIZATION OF THE SPACE SHUTTLE

Questions: Given the launch priority of the Defense Department, if the U.S. government were to decide not to buy or use any additional ELVs, what percentage of the total Space Shuttle launch capability would be needed by the Defense Department for national security payloads? What would be the impact of this high DOD utilization of the Space Shuttle on all other civil programs?

Answer: Preliminary estimates which assume three orbiters, no new DOD ELVs, a 12 month standdown, a rapid return to 18 flights/year and DOD launch priority, indicate the percentage of the total Space Shuttle launch capability the DOD would use is 82% in FY 87, 49% in FY 88, 54% in FY 89 and 50% in FY 90. Assuming a slower ramp up and a conservative flight rate of 15 flights/year, the percentage of the total Space Shuttle launch capability the DOD would use is 100% in FY 87, 78% in FY 88, 81% in FY 89 and 60% in FY 90. In both of these scenarios, the civil/scientific payload backlog is substantial.

NASA and DOD have formed a Shuttle manifesting working group to provide more accurate data.

House Cmte on Science & Tech	INSERT FOR THE RECORD				
☐ HOUSE ☐ SENATE	APPROPRIATIONS COMMITTEE	☐ HOUSE ☐ SENATE	ARMED SERVICES COMMITTEE	☐ HOUSE ☐ SENATE	OTHER
HEARING DATE 26 Feb 86	TRANSCRIPT PAGE NO. P2	LINE NO. Q14	INSERT NO. HST-14		

TYPE OF ELVs

Question: How many ELVs of each type do you believe should be employed each year by the Defense Department to help dispose of the "backlog" of unlaunched payloads that will exist by the end of 1989? CELVs? Titan 34Ds? Atlas/Titan II/Thor-Delta class?

Answer: In the wake of the Challenger accident, the DOD is developing a position on the number of additional ELVs necessary for a mixed fleet of space launch vehicles (ELVs and Shuttle). Since we are still in the requirements formulation process, the specific number of boosters needed has not been finalized. Our evaluation includes booster performance versus satellite requirements, defense contractor production capability, and use of Complementary Expendable Launch Vehicles (CELVs) on both coasts. Initial studies show that additional CELVs and medium-size ELVs will be required. The DOD is working with NASA and the Interagency Group to present a plan to the President in the near future.

House Cmte on Science & Tech **INSERT FOR THE RECORD**

☐	HOUSE	APPROPRIATIONS COMMITTEE	☐	HOUSE	ARMED SERVICES COMMITTEE	☐	HOUSE	OTHER
☐	SENATE		☐	SENATE		☐	SENATE	

HEARING DATE	TRANSCRIPT PAGE NO.	LINE NO.	INSERT NO.	
26 Feb 86	F2	Q15	HST-15	

AVAILABILITY OF ELVs

Question: How would the availability of these ELVs impact the desire to maintain assured access to space throughout the 1990s?

Answer: Procurement of additional ELVs strengthens our assured access to space for critical National Defense payloads, as well as, United States civil and commercial payloads. The Shuttle tragedy underscored the need for a mixed or balanced fleet for access to space. The balanced fleet concept, using the Shuttle and ELVs, will provide a robust industrial base and launch alternatives which will be viable throughout the 1990's.

House Cmte on Science & Tech	INSERT FOR THE RECORD			
☐ HOUSE ☐ SENATE APPROPRIATIONS COMMITTEE	☐ HOUSE ☐ SENATE ARMED SERVICES COMMITTEE	☐ HOUSE ☐ SENATE	OTHER	
HEARING DATE 26 Feb 86	TRANSCRIPT PAGE NO. P2	LINE NO. Q16	INSERT NO. HST-16	

ELV PURCHASE

Question: For those vehicles (e.g., Thor-Delta) for which the commercial supplier is someone other than the manufacturer, do you believe the government should buy the ELVs through the supplier or directly from the manufacturer?

Answer: Current DOD policy is procurement of launch vehicles through full-funded or multi-year contracting with the manufacturer. We did attempt a commercial funding approach in the early stages of the Complementary ELV program, but restructured that program at the direction of Congress.

In most instances, buying an item through a middle-man adds cost and reduces control; however, commercial procurement of launch vehicles may add economy of procurement by increased quantity buys when other customers are included. The Department of Defense is willing to consider each alternative on its merits and cost effectiveness, consistent with the direction of Congress.

House Cmte on Science & Tech	INSERT FOR THE RECORD						
☒	HOUSE SENATE	APPROPRIATIONS COMMITTEE	☐	HOUSE SENATE	ARMED SERVICES COMMITTEE	☐ HOUSE ☐ SENATE	OTHER
HEARING DATE 26 Feb 86		TRANSCRIPT PAGE NO. P2	LINE NO. Q17		INSERT NO. HST-17		

GOVERNMENT USE OF ELVs

Question: What effect do you believe government use of ELVs would have on the commercial viability of such vehicles as a competitor to the Ariane on the world market?

Answer: Expanded use of ELVs will provide a continuing U.S. production base for space boosters. With an established production capacity for government boosters, major production lines start-up and overhead costs for commercial launch vehicles are decreased or eliminated. In keeping with the President's policy on commercialization of space, this climate may encourage development of a viable commercial ELV launch capability that would provide satellite manufacturers with an alternative to Ariane.

House Cmte on Science & Tech	INSERT FOR THE RECORD			
☐ HOUSE ☐ SENATE	APPROPRIATIONS COMMITTEE	☐ HOUSE ☐ SENATE	ARMED SERVICES COMMITTEE	☒ HOUSE ☐ SENATE — OTHER Cmte on Science & Tech
HEARING DATE 26 Feb 86	TRANSCRIPT PAGE NO. P2	LINE NO. Q18	INSERT NO. HST-18	

OVERALL PAYLOAD DEMAND

Question: Please provide a summary table that compares for each year from now through 1992, the overall payload demand (in STS equivalents) that had been scheduled or planned to be flown versus the likely availability of Space Shuttle and ELV launch capacity. (Please assume a one-year downtime for the Shuttle fleet and the availability of a replacement Orbiter in 4 years.)

Answer: Assuming a 12 month Shuttle downtime, an additional procurement of ELVs (above currently planned) and a replacement Orbiter in FY 90, the following table shows the overall payload demand vs capability.

Space Launch Demand vs Launch Capacity
(Shuttle Bay Equivalents)

FY	86	87	88	89	90	91	92
Pre-Accident Demand	9	17	18	24	24	24	24
DOD Offload*	0	0	0	-2	-3	-2	-4
Commercial & Foreign	0	0	0	-3	-3	-3	-3
Adjusted Demand	9	17	18	19	18	19	17
NASA Planned Flight Rates**	0	6	14	15	22	24	24
Backlog	-9	-20	-24	-28	-24	-19	-12
Conservative*** Flight Rates	0	4	8	10	14	16	16
Backlog (conservative)	-9	-22	-32	-41	-45	-48	-49

* Assumes additional Complementary Expendable Launch Vehicles and medium payload weight capable vehicles

** Assumes 6 flights per orbiter per year

*** Assumes a conservative 4 flights per orbiter per year

ASSURED ACCESS TO SPACE - APPENDIX #3

HIGH FRONTIER

1010 Vermont Avenue, N.W. • Suite 1000 • Washington, D.C. 20005 • (202) 737-4979

Lt. Gen. Daniel O. Graham
USA (Ret.)
Director

April 3, 1986

APR [illegible] 1985

Hon. Bill Nelson
U. S. House of Representatives
Washington, DC 20515

Dear Congressman Nelson:

There can be little doubt that the poor state of affairs concerning US access to space has adverse effects on both of High Frontier's prime goals: Spaceborne defenses and free enterprise in space. Current solutions to this situation seem to range between halfway measures and a retrograde movement.

Our view as to what should be done is contained in the attached position paper.

Our emphasis is on turning free enterprise loose to solve the problem. If government had gotten out of the way of entrepreneurs in the past, we wouldn't be in today's bind, i. e. no spacelift capability.

Four immediate steps are necessary and sufficient for a competitive position of the United States in the 1990s:

(1) A block buy of next generation space shuttles by the US government;

(2) Private financing of a replacement orbiter of the current design;

(3) Immediate commercialization of Expendable Launch Vehicles (rockets) by the private sector and;

(4) Additive cost access to all US government space capabilities, including

- * a firm 'additive cost' price for all space shuttle launch services through the 1990s;
- * 'additive cost' access by US private enterprise to all ELV launch capabilities;
- * 'additive cost' access to all US government space capabilities in the 1990s, in particular, the space station.

(Note that none of these "breaks" for privatization are not substantially different from those provided by the government to civil aviation or the Merchant Marine.)

Rockwell can solve the current problems of the shuttle whether additional vehicles are bought for the private sector or for government.

We have the briefers available if you want more detail on these proposals.

Regards,

Daniel O. Graham
Lt. Gen., USA (Ret.)

/fjd

Enclosures

HIGH FRONTIER POSITION PAPER

IMMEDIATE STEPS TO REGAIN US SPACE TRANSPORTATION LEADERSHIP

THE PROBLEM.

With the grounding of the Space Shuttle for an undetermined time the United States is stranded and confused as to what steps should be taken to regain Space transportation leadership.

We submit that - despite the present calamity - a unique opportunity exists for this Administration to take several immediate steps to assure a competitive US Space Transportation capability with adequate backup. The proposed steps combine the public sector - NASA and DoD - with the private sector in an aggressive pricing policy to maintain US competitiveness in world markets in the next decade.

The recommendations made below follow closely successful transportation development policies of the United States in the past:

* Air transport - where the development of the technology was accomplished for over 60 years by NASA and NACA (the predecessor of NASA formed in 1916), where the infrastructure of airports and air traffic control was put into place by the US Government, and where the private sector has additive cost access to such Government services and facilities;

* Maritime transport - where again the Government built the infra-structure of ports and canals, coastguard and port services, with additive (if any) cost access by commerce; and

* Railroads - which were made possible by extensive land grants in centuries past.

All of the successes involved Government and industry cooperation rather than adversarial confrontation.

The stakes for the United States are high: if we falter, a $10 billion plus worldwide Space transportation market may be lost by the United States. This in particular if we flounder and continue to rely exclusively on Government to provide for our future in Space. We have to use all the Nation's resources - Government and Private Enterprise. And the Government's efforts should be directed to new technologies, rather than the operations of established capabilities.

The recommendations do not include the longer term need to advance US Space technology development needs such as the aerospace plane.

RECOMMENDED FOUR POINT PROGRAM.

POINT 1: NASA Block-Buy of Next Generation Space Shuttles.

NASA shall be directed to procure the next generation Space Shuttle fleet with an initial buy of, say, four Orbiters. Enough is known about SDI and Space Station requirements in the next decade, and the technical shortcomings of the current design of the Space Shuttle to warrant such a forward looking directive. The selection of the definitive configuration may require from six months to two years of 'design competition' with procurement to follow. No new technology breakthroughs are needed.

POINT 2: Replacement Orbiter through Private Funding.

A 'carbon copy' replacement Orbiter can be financed by the private sector up to, say, $2 billion, as proposed in public testimony to Congress on March 19, 1986. The only issue is wether Congress will agree to the necessary terms and conditions as proposed by the private sector. With such private funding would go the removal, once and for all, of NASA from any commercial marketing activities, a job much better left to the private sector. European success has proven that. (ArianeSpace, SpotImage, IntoSpace).

If Congress does not 'allow' such private funding, so be it. No national calamity shall ensue as long as the other three steps recommended herein are taken as well. But the American people will know from then on where the bottleneck for wider commercial uses of Space is.

POINT 3: Commercialization of ELVs by the Private Sector.

Direct NASA and the DoD to promptly transfer all responsibilities for Non Defense uses of ELVs to the private sector, whatever systems are involved and let the market decide which are viable and which are not. Fundamental to such a transfer is step four below - namely additive cost access to any Government controlled facilities, services and hardware.

POINT 4: Additive Cost Access to all US Civil Space Capabilities.

Fundamental to the recovery from the current situation is a long term - 10 to 15 year - commitment by the US Government to Additive (incremental, marginal) cost access to all US Government facilities, services and hardware by the private sector to elicit the broadest possible use of US Civil Space capabilities in world markets.

Specifically this means:

4.1 Fixed, Additive Space Shuttle Pricing Through Next Decade.

The Shuttle User Charges shall be set now based on expected Additive Costs of one additional Shuttle launch per year. This expected cost/price shall be set now through the 1990s and be held fixed for launch and retrieval missions, whatever the successes or failures of NASA management from now on. Such a price is probably in the neighborhood of $90 to $100 million for a dedicated Shuttle launch, allowing for new safety requirements.

4.2 Additive Cost Access by Private Sector ELV Initiatives.

NASA, DoD, and any other concerned US Government agency shall be directed to enter into any private sector ELV agreements on an additive cost basis.

The 'Additive Cost Access' principle means that the Government shall ask the private sector for reimbursement of only those costs (budgetary expenditures) that are incurred and proven to be incurred by the Government in addition to what the Government would have done anyhow without such private activities in any one year or period of years. Other than National Security (DoD) procurement of ELVs the Government shall solicit and rely on commercial ELV launch services, if such services are offered by the private sector. Rather than reopen such civil Government activities, NASA and DoD shall do everything to facilitate private sector ELV services.

4.3 Additive Cost Access to US Government Space Capabilities.

In addition, to foster the widest and earliest possible use of US Space capabilities in world markets the US Government shall be directed to give US Industry and people additive cost access to all Government facilities, services, hardware and platforms, including the Space Station, throughout the next decade.

By taking these specific steps the US Government will create the certainty and confidence needed to continue the conquest of Space by the United States in free enterprise for the benefit of mankind.

FOR IMMEDIATE RELEASE 4 April 1986

CONTACT: Bruce Hallman 202/737-4979

HIGH FRONTIER'S SOLUTION TO THE SPACE TRANSPORTATION IMPASSE

Washington, DC--Saying, "Business as usual is out," Lt. Gen. Daniel O. Graham, USA (Ret.), Director of High Frontier, advocated an increased role for the private sector in space transportation. "Failures cannot be compounded in the space program by continuing to follow the failed policies and methods of the past. There is another way to move," said Graham.

He continued, "Out of the confusion, uncertainty, and dismay caused by the Challenger catastrophe come demanding, disturbing questions." Among them: How can the United States overcome the effects of a hiatus in access to space with the least commitment of the nation's wealth? In a time of financial constraints, can the space program move from setback to greatness with a new approach?

In his eulogy for the Challenger astronauts, President Reagan emphasized a profound truth: "the future is not free, the story of all human progress is one of struggle against all odds." In the past, our country has risen from disaster to achievement through courage and determination. From the shock following the Pearl Harbor attack, the "day which will live in infamy," our nation gained victory for the free world in four short years through a simple formula--private industry, labor, and government, working round the clock, in tandem and with a common goal, proved Americans could not be stopped.

We can do it again, with a new opportunity--in space.

This country has a unique chance to ensure a competitive American space transportation capability if we move ahead aggressively. NASA, the Department of Defense, and the private sector, in combination, can take the lead in world markets in the next decade. It's a high stakes concept. If we falter or procrastinate, a multi-billion dollar market may be lost.

Restoration of the US space transportation capability in the shortest possible time with the least cost and the highest long-range payoffs is crucial to both the security uses of space (SDI) and to the enormous economic benefits available. We cannot do this well without full non-government participation, without bringing to bear the powerful engines of free enterprise.

High Frontier, therefore, makes the following four urgent recommendations:

1. A NASA Block-Buy of Next Generation Space Shuttles

Congress must direct NASA to procure the next-generation space shuttle fleet with an initial buy of four orbiters. Enough is known about SDI and space station requirements in the next decade and the technical shortcomings of the current shuttle design to warrant such a forward-looking directive now. The selection of the definitive configuration may require from six months to two years of "design competition," with procurement to follow. No new technological breakthroughs are needed.

2. Purchase of a Replacement Orbiter Through Private Funding

A "carbon copy" replacement orbiter can be financed by the private sector, up to about $2 billion, as proposed in public testimony to Congress on 19 March, 1986. The only issue is whether Congress will agree to the necessary terms and conditions as proposed. With such private funding would go the removal of NASA from any commercial marketing activities, a job better left to the private sector (as proven by the European experience).

3. Commercialization of Conventional Rockets (Expendable Launch Vehicles) By the Private Sector

Congress must direct NASA and DoD to transfer promptly all responsibilities for non-defense uses of ELVs to the private sector, whatever systems are involved, and let the market decide which are viable. Fundamental to such a transfer is step four, below.

4. Additive Cost Access to All U.S. Space Capabilities

NASA and DoD, along with any other concerned government agencies, shall be directed to enter into any private sector ELV agreements on a additive cost basis, meaning the government shall not seek reimbursement from the private sector of costs other than expenditures incurred (and proven to be incurred) by the government in addition to what the government would have done without such added activities and without time restraints. Other than procurement of ELVs for national security missions by DoD, the government shall solicit and rely on commercial ELV launch services, if such services are offered by the private sector. Rather than re-open such civil activities, NASA and DoD shall do everything possible to facilitate and encourage private sector ELV services. In addition, to foster the widest and earliest possible use of U.S. space capabilities in world markets, the government should be directed to give industry additive cost access to all its facilities, services, hardware, and platforms, including the space station, in the years to come. (This proposal is not basically different from the way government has always supported the civil air and maritime industries, where government provides basic needs--airports, air traffic control, ports, canals--in the national interest.)

"The team concept of government and free enterprise working together in the national interest can restore the confidence of Americans who are looking to space in the next decade," Graham concluded. "Will generations to come praise or condemn us on how we handle this responsibility now?"

# # #

NOTE: ASSIGNMENT EDITOR
General Graham, and High Frontier Scientific Advisor Dr. Klaus Heiss, will be the guests of the National Press Club at its Newsmaker Breakfast on Wednesday, April 30, 1986.

ASSURED ACCESS TO SPACE - APPENDIX #4

HUGHES

ALLEN E. PUCKETT Chairman of the Board and Chief Executive Officer

23 April 1986

RECEIVED
APR 2 9 1986
COMMITTEE ON SCIENCE
AND TECHNOLOGY

The Honorable Don Fuqua
Chairman
Committee on Science & Technology
U. S. House of Representatives
Washington, DC 20515

Dear Mr. ~~Chairman:~~ Don,

Many members of our industry, including myself, are deeply concerned about the future ability of the United States to reliably and economically launch the communication satellites that Hughes and other American firms build. You will recall that we discussed this briefly in your office last week, and this letter is simply to re-emphasize our thoughts.

As you know, the United States has vigorously encouraged the adoption of communication satellite technology. After twenty years, the world relies on our satellites and on our launch vehicles to provide virtually all international satellite communications. At our urging, many countries have begun to rely on this new technology for vital domestic communications — Canada, Japan, Australia, Indonesia, Mexico, Brazil and India. The U.S. is especially dependent on such satellites.

American firms and programs have been the principal beneficiaries of this revolution, booking about two billion dollars a year in sales. They also are the explicit and implicit guarantors of service continuity.

American Government policy for fifteen years has been to compel communication satellites to rely exclusively on the Space Shuttle. Conversion to the shuttle is almost complete; the Delta and Atlas Centaur production has ceased, and the last few vehicles will be launched in the next year. The only realistic alternative to the shuttle is the French/European Ariane, and possibly the Chinese and Russian rockets that are now being offered.

In the wake of the Challenger tragedy, some parts of government are advocating moving commercial users off the shuttle after 1988 by refusing future bookings and abrogating existing launch contracts. This policy would profoundly damage the U.S. Satellite industry. There are no U.S. firms of substance committed to supplying appropriate launch vehicles. The only beneficiary of this policy would be the European Ariane program, to whom all American satellite builders and operators would become hostage. The Europeans will use this new monopoly to further their own ends and threaten this very successful high technology export industry.

Corporate Offices: 7200 Hughes Terrace
P.O. Box 45066, Los Angeles, CA 90045-0066
(213) 568-6100

The Honorable Don Fuqua
23 April 1986 - Page 2

It is inconceivable to me that the shuttle, which was developed at great public expense, would be denied to an important segment of the public — the commercial users — when every other industrial country in the world is encouraging and subsidizing its commercial space users. The satellite communications business requires long-term investments of hundreds of millions of dollars. Firms will not make such investments without confidence that their launch requirements will be met. If we insist that this large vessel change course rapidly, it will sink.

An appropriate long-term policy would be to encourage domestic production of expendable launch vehicles to support our own activities, as well as to assure friendly governments and allies alike of continued access to space. Such assurance does not now exist. It will probably take a least four years to recreate an expendable launch vehicle capability. Such a capability will certainly be based squarely on unmanned vehicles already developed at government expense, such as Delta, Titan, or Atlas Centaur. In the meantime, it is essential that we restore confidence in American ability and willingness to launch commercial communication satelites. To do less is to forfeit this field and its bright future.

I would be pleased to provide any other information that would be helpful to you.

Sincerely,

Allen

ALLEN E. PUCKETT

/lb

cc: The Honorable Manuel Lujan, Jr.
The Honorable Bill Nelson
The Honorable Robert S. Walker

ASSURED ACCESS TO SPACE - APPENDIX #5

KSC Mishap No. 86-0024

Report Of SRM Handling Ring Mishap Investigation Board

No. 3 Of 120 Copies

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National Aeronautics and
Space Administration
John F. Kennedy Space Center

NASA

KSC FORM 16-13 (REV. 8/78)

KSC MISHAP NO. 86-0024

REPORT OF
SRM HANDLING RING MISHAP
INVESTIGATION BOARD

AUTHORIZATION:

Letter dated November 12, 1985
CD/Director to SE-ETD/Chief, Electrical and Telecommunications System Division

BOARD MEMBERS:

J. E. Smith, Chairman (KSC - SE)
William L. Cannon, Member (KSC - DD)
John E. Key, Member (MSFC - SK)
Russell P. Lloyd, Member (KSC - SL)

EX-OFFICIO MEMBER

Douglas G. Hendriksen (CC-P), Legal Advisor to the Board

EXECUTIVE SECRETARY AND STAFF:

James B. Lansing (SF-ENG), Safety Advisor/Recorder
Herbert Weisner (SE-PEO), Staff
Andrea Shea-King (PA-PIB), Staff

SUBMITTAL SIGNATURE: J. E. Smith
J. E. Smith
Board Chairman

12-13-85
Date

EXECUTIVE SUMMARY

On November 8, 1985, at approximately 6:10 p.m., the forward center segment of the left hand (A) Solid Rocket Motor (SRM) scheduled for use on STS-33 was damaged during the Ground Support Equipment (GSE) forward handling ring removal operations at the Rotation Processing and Surge Facility (RPSF). Subsequent investigation revealed damage to the SRM segment clevis and holes as well as damage to two GSE segmented ring segments. The forward center SRM segment had previously been removed from the rail car, rotated, aft handling ring removed, and installed into the workstand per Task 11 of OM B5308, "Offload and Inspect Aft Center, Forward Center, and Forward Segments."

At the time of this mishap, the segment lifting beam had just been attached to the forward handling ring per Task 25 of OM B5308, and technicians were in the process of removing 129 shipping pins that secured the segmented portions of the forward handling ring to the SRM segment.

The lead technician elected to pick up the approximate weight of the segment handling ring to aid in the removal of 31 shipping pins still in place. He requested the crane ground controller, located on the platform with him, to pick up 11,000 pounds. The crane ground controller relayed this information to the crane operator. While watching his load cell digital indicator, the crane operator initiated a very slow up command. RPSF taped radio transcripts show that after approximately 85 seconds, a loud bang was heard and the segment lifting beam jumped upwards. An emergency shutdown of the crane system was made. During this entire process, interviews indicated the load cell digital indicator being observed by the crane operator read zero. The area was secured and an investigation of the mishap was begun.

On the evening of the mishap, the portion of OM B5308 specifying removal of the forward handling ring was clearly not being followed. The lifting sequence calls for first attaching the lifting beam to the handling ring, then loosening the 132 bolts connecting the segmented ring to the solid handling ring, removing the 129 shipping pins, and then lifting the forward handling ring off with the crane. A caution note listed prior to the step which provides for the removal of shipping pins prohibits crane movement until all shipping pins have been removed. During the mishap, the technicians removed 98 shipping pins without loosening the 132 bolts, and then gave instructions to raise the crane.

Running of OM B5308 is a locally controlled operation under the direction of a Morton Thiokol lead technician. Participation of quality control personnel in this operation consists primarily of after-the-fact verification of milestone completion (i.e., lifting fixture connected to forward handling ring). Therefore, steps in the OM can be deviated or omitted without quality personnel cognizance.

Subsequent investigation of this mishap indicates it has become common practice to use the crane to take up the load of the segment handling ring to facilitate removal of shipping pins that would be difficult to remove otherwise. The load cell has been utilized to indicate when the weight of the segment handling ring has been transferred to the crane.

After the incident, appropriate action was taken to secure the work area. Proper NASA and contractor personnel were notified, the load removed from the crane, the crane disconnected from the SRM segment, and photographs taken for proper documentation.

Precise dollar amounts regarding damage inflicted are presently not available. Estimates range from a minimum amount if the SRM segment can be refurbished to the cost of a new SRM segment if refurbishment is deemed not feasible.

Lockheed Space Operations Company

1100 Lockheed Way
Titusville, Florida 32780

15 November, 1985

TO: J. Smith
Chairman
NASA Mishap Investigation
Board Chairman

FROM: W. J. Kapryan
Chairman
LSOC Mishap Investigation Board

SUBJECT: BOARD INVESTIGATION REPORT OF SRM FORWARD LIFTING RING REMOVAL, 11-8-85

Attached is a copy of the LSOC Mishap Investigation Board Report for your review. This will conclude the activities of the LSOC Mishap Investigation Board. Formal closeout of the mishap will be handled through the KSC Mishap Reporting and Corrective Action System through NASA as stipulated by CDRL 004. Any questions may be directed to myself or H. C. Robbins, SPC Safety.

W. J. Kapryan
W. J. Kapryan

WJK/lt

SRM SEGMENT MISHAP

November 8, 1985

INVESTIGATION REPORT

LOCKHEED SPACE OPERATIONS COMPANY
KENNEDY SPACE CENTER, FLORIDA

COPY 2 OF 20

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INDEX TO FINDINGS

FINDING #1 - OMI PROCEDURE WAS NOT FOLLOWED

FINDING #2 - OMI PROCEDURE INADEQUATE TO ACCOMPLISH TASK

FINDING #3 - TEST TEAM LACKED DISCIPLINE

FINDING #4 - TECHNICIAN LIFT COORDINATOR LACKS ADEQUATE TRAINING

FINDING #5 - THERE WAS AN APPARENT CRANE LOAD CELL FAILURE

FINDING #6 - CRANE CREW REPORTING OF ANOMALIES IS INADEQUATE

FINDING #7 - TRAINING REQUIRED BY PROCEDURE HAD NOT BEEN ACCOMPLISHED

Rev. A

Finding #1 OMI PROCEDURE WAS NOT FOLLOWED

The SRM mishap occurred during the course of removing the shipping segment rings and the shipping pins (B5308-A) from a left forward SRB segment.

It was determined from the employee work force depositions that work was not being accomplished in the sequence prescribed by OMI-B5308-A. There were indications that this was not a first time occurrence.

The OMI Procedure prescribes that no clevis shipping pin removal or crane lifting shall occur until the bolts connecting the forward handling ring to the ring segment sections have been de-torqued. This is stated in the "Caution" note preceeding Step #6 which then calls for the removal of the clevis shipping pins.

Despite this caution note, 98 out of a total of 129 pins were removed.

RECOMMENDATION

The corrective action is to follow the prescribed sequence specified in OM B5308-A.

Issue a Management Alert stressing the importance of compliance to the OM.

FINDING #2 OMI PROCEDURE INADEQUATE TO ACCOMPLISH TASK

OMI Procedure B5308-A is inadequate to normally accomplish the task without Engineering involvement and disposition. For example, there are no instructions in the OMI to enable removal of any clevis shipping pins that cannot be removed after the bolt de-torquing operation.

RECOMMENDATION

The OMI should be reviewed and revised by Morton-Thiokol Operations and LSOC Engineering to provide more complete instructions for safe pin removal when bound by the weight of the transportation handling ring.

Morton-Thiokol Wasatch Divisions Document TWA 1114, Rev. A might be used as a reference for this revision.

FINDING #3 TEST TEAM LACKED DISCIPLINE

Employee depositions also indicated some lack of discipline in assuring compliance to the OMI sequences as well as follow-up in problem reporting. This was evidenced in work being performed out of sequence and an apparent lack of sensitivity to the operation being performed.

The general attitude was one of "I was doing something else at the time", "I only look at what I have responsibility for", "that's not part of my job".

RECOMMENDATIONS

- Faithfully conduct pre-test briefings, documented, to inform all participants of the critical elements of the operation and their required participation.
- It should be stressed to the Team Leader that he is responsible for the discipline of the team and for its performance.

FINDING #4 TECHNICIAN LIFT COORDINATOR LACKS ADEQUATE TRAINING

The practice for Flight hardware handling is that the crane ground controller is directed by a member of the technician workforce who performs as a lift coordinator. There is no training nor certification required for this function. Considering the number of Hi-value program-critical operations this involves, the potential for other mishaps of this nature must be recognized.

RECOMMENDATION

That a certification position for "critical lift coordinator" be established. In addition to selected Technical Training courses, specific OJT programs should be developed for lifts occurring within specific flight element processing facilities.

FINDING #5 THERE WAS AN APPARENT CRANE LOAD CELL FAILURE

An apparent intermittent failure of the load cell system of the No. 2 200-ton RPSF Crane contributed to the resulting damage of the SRB segment. Testimony from the two crane operators established that the load cell digital readout remained at zero throughout the crane sequence in which it was attempted to produce a lifting force of 11,000 lbs. as requested by the Thiokol lead and relayed by the crane ground controller. Additional testimony from several certified crane operators indicated a history of erratic operation of the load cell system.

During the safing steps following restoration of power to the crane, crane operators reported a load cell digital display reading of -220,000 lbs. This appears to have been an indication of the actual lifting force applied to the SRB segment at the time of the incident. Analysis of fracture evidence also indicates that lifting forces were in excess of 215,000 lbs.

Testing of the crane and load cell, approved by the investigation board, produced data which supports this finding. A committee review of the 200-ton crane OMRSD and SAA failed to disclose any requirements or analysis of the load cell system. Testimony from the Thiokol supervision, engineering, and technicians failed to disclose specific requirements for the load cell's use. Crane procedures and segment handling procedures do not call for its use.

Contact with the load cell manufacturer disclosed that the load cell installation did not meet basic requirements involving its power supply. The manufacturer states that the unit can be damaged by power interruptions as it is presently installed.

Crane maintenance procedures do not call for any periodic maintenance or calibration of the load cells because the load cell system was intended to provide a "gross indication" and was not a requirement for operational accuracy.

RECOMMENDATION

Prior to returning the two RPSF cranes to service, their respective load cell systems should be disabled and signs placed in the crane cabs to discontinue their use until further notice.

Thiokol Operations and LSOC Crane management should sign a mutual agreement that the cranes are safe and effective for use in the RPSF with the load cell system disabled.

Specific operational requirements must be established for the load cell's use prior to returning them to service. If there is a requirement, a system level review (including FMEA) must be conducted.

FINDING #6 CRANE CREW REPORTING OF ANOMALIES IS INADEQUATE

The reporting of crane anomalies by the crane operating personnel is inconsistent and at times is nonexistent. The No. 2 Crane log book contained entries over a nine-month period, yet contained no mention of erratic load cell readings. Testimony from the crane crew of five gave three methods of reporting problems: one - verbal notifications to supervision or engineering, two - entry in the crane log book, and three - notation on the crane preoperational checklist sheet which is to be returned to supervision.

RECOMMENDATION

Anomaly reporting method should be enforced by LSOC Crane management. Written instructions should be placed in the front of each log book. Crew briefings should be held by management to emphasize the need to report and record all anomalies regardless of their duration or immediate impact upon the operation in process.

FINDING #7 TRAINING REQUIRED BY PROCEDURE HAD NOT BEEN ACCOMPLISHED

DISCUSSION

The training required for SPC Crane Operation is:

OJT - OJH 210
Safety - TG-340
Practical Exam
License

A record search revealed that all Crane Operators are certified.

The training required per OMI B5308 for the MTI Technicians and Job Card 973[illegible]3 is governed by the following documents:

QB-309-USB	SRM Assembly and Checkout
QT-523	Bonding, Grounding
QB-400-USB	Ordnance Handling
OJT-2-USB	Work Platform Operation

The Board was unable to verify that the MTI Technicians have received the OMI required training.

RECOMMENDATIONS

1. MTI Management should define the training requirements for this operation and get the OMI changed to reflect these requirements.
2. Department records should be developed and maintained so that supervision knows who has been trained and when re-training is required.
3. Inputs must be made to SPC Training Department so that training records can be updated to provide accurate training visability.
4. SPC Training records need to be improved. They need significant updating.

FINDING #8 TRAINING REQUIRED BY PROCEDURE HAD NOT BEEN ACCOMPLISHED

DISCUSSION

The training required for SPC Crane Operation is:

OJT - OJH 210
Safety - TG-340
Practical Exam
License

A record search revealed that all Crane Operators are certified.

B

The training required per OMI 85308 for the MTI Technicians and Job Card 97313 is governed by the following documents:

QB-309-USB	SRM Assembly and Checkout
QT-523	Bonding, Grounding
QB-400-USB	Ordnance Handling
OJT-2-USB	Work Platform Operation

The Board was unable to verify that the MTI Technicians have received the OMI required training.

RECOMMENDATIONS

1. MTI Management should define the training requirements for this operation and get the OMI changed to reflect these requirements.

2. Department records should be developed and maintained so that supervision knows who has been trained and when re-training is required.

3. Inputs must be made to SPC Training Department so that training records can be updated to provide accurate training visability.

4. SPC Training records need to be improved. They need significant updating.

OBSERVATION #1 PERSONNEL INVOLVED FELT CRANE EQUIPMENT PERFORMANCE/RELIABILITY IS QUESTIONABLE

Statements by the crane operators and Morton-Thiokol technicians disclosed a general concern regarding reliable operation of the crane equipment. A PRACA data review listed 44 PRs against the cranes since acceptance by LSOC, four of which were recent interruptions with a suspended segment.

RECOMMENDATION

An engineering study should be initiated to review RPSF crane operating requirements to satisfy all support needs in the Rotating, Processing and Surge Facility.

Testing should be conducted as necessary to determine if the present crane capabilities can satisfy the RPSF support requirements. In addition, a review should be made of all crane anomalies to assess the systems overall reliability.

Discrepancies in reliability and operating performance should be documented by PR and corrective action pursued through system adjustment and/or design change.

The PRACA system should be programmed to issue a special problem recurrence notification on cranes after a pre-determined number has been exceeded.

OBSERVATION #2 THERE WAS INSUFFICIENT QUALITY GENERAL JOB SURVEILLANCE

Quality Control personnel allowed operations to deviate from approved procedure. Although there is not a specific call out for Quality Control to witness the removal of shipping pins, they are a part of the operations team and do have Quality buys in this operation.

RECOMMENDATIONS

A specific Quality buy should be added to OMI B5308-A to insure removal of shipping bolts is being done in accordance with acceptable procedures.

The role of Quality Control needs to be defined by management. Inspectors need to be instructed on the SPIs which relate to Quality Control functions.

All Inspection personnel, should be aware of the QA series SPIs: QA-049 Surveillance Inspection, QA-001V PRACA, and QA-005 Stop Work Procedure should be mandatory reading.

PRIVATE FINANCING OF A SPACE SHUTTLE ORBITER - APPENDIX #1

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April 30, 1986

The Honorable Bill Nelson
U.S. House of Representatives
307 Cannon House Office Building
Washington, D.C. 20515

Dear Congressman Nelson:

On behalf of Mr. Willard Rockwell, Jr. and General Space Corporation, we are forwarding the enclosed responses to the written questions submitted by your Subcommittee. As you know, this is in follow-up to last month's hearing on private sector financing alternatives for the Space Shuttle.

We remain appreciative of the personal interest you have shown for General Space's concept, and for the time devoted to it by your Subcommittee. General Space is, of course, available for any further information, or to answer any additional questions, which might prove helpful to you as consideration of our plan moves forward.

Very truly yours,

James W. Cicconi

/jf
Enclosure

cc: Mr. Willard F. Rockwell, Jr.

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS

Questions for Mr. Willard Rockwell, Jr.

1. **What is the current status of your company's initiative to privately finance an Orbiter?**

At the present time, General Space is continuing its discussions with the Congress, NASA and other government agencies in order to explain the concept we have already outlined to the Subcommittee.

We have been informed that NASA intends to go forward with a Request for Proposals (RFP) in the near future. General Space is currently engaged in ongoing conversations with the investment banking community and with other intensive planning in preparation for formulating a detailed and viable response to any such RFP.

In addition, as part of our planning process in connection with the shuttle financing concept, Astrotech and General Space are engaged in a restructuring which will, we feel, enhance our competitive position in space operations generally.

2. **You propose a long-term lease agreement whereby NASA would lease the Orbiter from General Space.**

   a. **Regardless of the length and structure of a lease arrangement, government funding would continue to be subject to availability of appropriations. How would you respond? Isn't a stronger government commitment needed for your investors?**

Our proposal for a long-term lease agreement is necessary in order to secure the requisite private sector financing to build an orbiter. This, of necessity, involves a certain degree of "up front" assurance by the federal government that any such agreement would be honored during its term. We recognize, of course, that NASA lease payments would still be subject to annual appropriations.

A long-term federal contract commitment such as that suggested by General Space is not unprecedented and could, we feel confident, be formulated in a way that addresses adequately both the needs of investors and the uncertainty associated with future appropriations.

b. What percentage of the total STS commercial market or total STS commercial revenue pool would your initiative seek in return?

The long-term lease agreement we propose is independent of commercial market size or revenues. General Space is not seeking an assured percentage of either. The extent to which any commercial launch revenue is used to offset the cost of the lease would be determined entirely by NASA. As outlined in our plan, General Space Corporation proposes to assist in marketing such commercial launch activity as NASA decides to undertake.

3. Can you discuss how you would structure a financial arrangement to:

a. cover insurance costs,
b. provide an attractive return on investment,
c. be advantageous to the government?

Regarding insurance, we would refer the Subcommittee to our previous testimony on this subject. As for the other aspects of your question, we would expect to provide such information, in detail, as part of our company's response to NASA's anticipated RFP. Since NASA has already indicated that such points will be key factors in evaluating any private sector financing proposals, putting forth our position at this point would be premature, and would place General Space at a competitive disadvantage in the RFP process. We can assure you, however, that we are confident such questions can be addressed in a way that will withstand any reasonable analysis.

4. Can you comment on your company's ability to proceed with these plans given Astrotech's losses for the last two years -- (according to your annual report)?

First of all, it is not unusual for companies such as Astrotech to sustain losses when most operations are still in the research and development stage. Overall, the corporation is in sound financial condition, and is proceeding with plans for its General Space subsidiary to become an independent company. Second, the assurance of private sector financing, which we assume any company would have to demonstrate in order to secure a long-term government lease, would provide the requisite guarantee of General Space's ability to proceed.

5. **What do you see as the major benefits to NASA, the country and private industry of a privately funded Shuttle?**

NASA and the Nation would benefit greatly by virtue of the restoration of shuttle fleet capability. Voluminous testimony presented to the Committee has documented the serious consequences of the present loss of capacity in a system which is to be our prime means of space transportation for at least another 15 years. The Nation and its industries will also benefit through NASA's ability to maintain its launch services and the commercialization commitments made to U.S. industry. In addition, we would expect that the success of a privately funded shuttle would spur additional private sector involvement in the space program in a way that benefits the government's commercialization goals. Finally, in a period of fiscal austerity, privately raised funds could be used to avoid substantial outlays for a replacement orbiter.

6. **Your company has proposed:**

   1. **financing an orbiter**
   2. **purchasing the rights to the Fairchild leasecraft**
   3. **developing an orbiting power station**

   a. **Do you contemplate doing all of these things at once?**

General Space's organization and business planning have been based on the development and operation of multiple programs operating as organizational divisions or subsidiaries. Thus, we expect to have the necessary staffing and funding to sustain all of the programs we have begun.

7. **The government has invested over $16 billion in the Shuttle system. Please justify why the government should sell an Orbiter to your company at a fixed price in order to bring your company a significant profit by marketing its use. I call your attention to the second condition in NASA's January 14, 1986, request for expressions of interest which requires appropriate recognition of the government's investment.**

We are fully cognizant of the tremendous investment the government has made in the Shuttle system. At the same time, we would point out that NASA is committed to the policy of commercialization. We are unaware of any Congressional intent, express or otherwise, that requires private entities to fully recompense government research and development costs -- in fact, quite the opposite. As with the aircraft industry, and more recently with COMSAT and privatization of the Delta launch system, there is ample precedent for government development of costly and experimental systems, and the subsequent privatization of such systems once they have reached a stage appropriate to commercial use. We believe our proposal is consistent with this precedent, and also with established government policy.

It is true that General Space's proposal will be structured to allow the company's investors a fair profit -- this is true of every arrangement NASA has with private companies and contractors. It must also be recognized, however, that the principal purpose of the proposals is to provide the government with an asset it needs -- and which it plans to acquire -- in a manner which benefits the government, industry, and the public.

We would not expect the government to agree to a private sector proposal of any sort, including financing, unless it were determined that there is some advantage to be derived for the government and the public generally. In the case of General Space's plan, that advantage would be the securing of an additional asset for government use -- namely an orbiter, which might not be obtained absent private funding -- in a manner which benefits the government, industry, and the public. In addition, private sector marketing would increase commercial launch activity, the profits from which would be shared by the government. The benefits of increased utilization of space would be shared by everyone.

8. **Tax implications must obviously be a major consideration of your proposal. Can you share your understanding of the tax consequences of your proposal?**

In a period when the Congress is debating major changes in the tax laws, it is difficult to comment on the tax consequences of the plan. Obviously, the taxation aspect of any such proposal is a major point to be agreed upon with the government, since private investors will naturally require some degree of certainty regarding the tax treatment of their investment.

We propose to structure the plan in such a way that, considering all relevant factors, including the status of the tax laws at that time, the plan will represent an attractive investment for all parties.

9. **As the tax legislation moves through the Congress, there are numerous questions unanswered concerning its effect on your proposal. However, based on tax law changes made under the 1984 Deficit Reduction Act--**

   --no investment tax credit would be allowed for property leased to a tax-exempt entity (e.g., NASA); and
   --property leased to a tax-exempt entity (i.e., Shuttle leased to NASA) would not qualify for accelerated depreciation.
   How does this affect your proposal?

   We would respond by referencing our answer to question number 8.

10. **Are the terms and conditions set forth in the Commerce Business Daily notice acceptable to you?**

    Yes, as manifested in our positive response to NASA's notice.

11. **What terms and conditions would you find essential before you consider entering into an agreement to fund an Orbiter?**

    Based on our detailed conversations with the investment banking community, we feel the government's agreement to a long-term lease is the most essential condition for obtaining private financing for construction of an additional orbiter. There is, of course, ample precedent for such arrangements between the government and private entities. We would refer you to our previous testimony regarding other aspects of our plan.

12. **Would your initiative provide for exclusive use of the Orbiter by the government in the event of a national emergency?**

    Of course.

    a. If so, what compensation would you seek?

    General Space would seek no compensation in such circumstances.

As noted in our previous testimony, the only compensation General Space would receive under its concept would consist of lease payments plus certain marketing incentives tied to commercial launch activity.

13. **Would NASA retain all scheduling and manifesting responsibility and authority?**

Yes.

14. **A year ago, the Smylie Commission studied the transfer of Shuttle management and marketing to a private entity, and found it "not a viable alternative for the foreseeable future," on the basis that:**

--the Shuttle's use as a policy instrument would be difficult if run by private enterprise;
--access to space upon demand by DOD could be impeded;
--private management would be uneconomical for the Federal government, the primary Shuttle user;
--transfer to a commercial entity could inhibit other commercial endeavors (i.e., profitability could inhibit innovative or experimental use);
--inability to obtain insurance would mean liability would have to rest with the government.

Can you respond?

Since General Space's proposal does not affect NASA's continued role in operation and management of the Shuttle, the Smylie Commission conclusions cited do not apply.

15. **We are seeing a reevaluation of attitude toward government use of expendable launch vehicles. Current circumstances may also present new opportunities for the commercial ELV market.**

a. How has the Shuttle accident changed your view of the market for launch capacity?

We feel that the commercial market for Shuttle services is still present, and that its customers will be resilient in their planning until flights resume. The accident may require NASA's assurance that it still intends to honor its launch commitments, though, especially to those programs which were forced to base their planning on use of the Shuttle.

b. What role do you see for ELV's in the future?

It is our view that there is a definite role for U.S. ELV's, at present and in the future, if they can prove themselves cost competitive with both the Shuttle and Ariane.

c. How do you see increased government and commercial use of ELV's affecting the commercial competitiveness of a privately owned Shuttle Orbiter?

At the time NASA phased out use of ELV's, it made a fundamental commitment that Shuttle prices would be maintained at a level attractive to all users. Provided this commitment is kept, we have no worries about the commercial competitiveness of a privately owned orbiter.

16. **Some have suggested the need for a "kick-start" from the government to get the commercial ELV industry off and running, (e.g., guaranteeing a number of payloads to fly on ELV's in any given year).**

a. How would a move like this affect your plans?

It is our view that guarantee of a certain number of government payloads to ELV's will not sustain an ELV program unless it can prove itself price competitive with the Shuttle and Ariane.

If such a move took place, we would anticipate no near term affect on the General Space concept. Should a successful, competitive ELV program emerge, it could conceivably have an impact on the long-range marketing aspect of our plan, but would have no impact per se on the Shuttle leasing aspect.

b. Can you comment on the government's role relative to your operation and the commercial ELV industry?

The government's role relative to ELV's is not a General Space concern except as noted above. It should be recognized, however, that, with reference to question number 7, the government has agreed to privatize its ELV's without compensation for the research and development costs of these programs.

17. **Identify precisely where the risk to be undertaken by the private sector lies in the 1) lease arrangement contemplated by Astrotech, and in the 2) marketing side of the venture.**

Since NASA has indicated its intention to move forward with a formal Request for Proposals (RFP) on the shuttle financing concept, it would be premature, and would place General Space at a competitive disadvantage, to disclose such precise details at this point, especially since the "risk factor" will undoubtedly be one aspect of the RFP. We are confident, though, that we will be able to demonstrate sufficient corporate risk to satisfy NASA criteria.

18. **What is the expected upfront private capital investment required to provide for the marketing side of your contemplated venture?**

At this point, we consider such information to be proprietary.

19. **By how many Shuttle flights/year do you estimate your marketing efforts would increase commercial demand for the Space Transportation System (STS) above that which would accrue to a 4 Orbiter NASA fleet anyway, in the absence of your proposed venture?**

That is obviously difficult to estimate, since a "baseline" would first have to be agreed upon with NASA. However, it is reasonable to assume, given the admitted constraints on NASA's ability to effectively market the Shuttle's services, that vigorous private sector marketing would provide additional mission opportunities. The government would clearly benefit from any missions beyond the number otherwise expected, and would incur no loss if additional missions were not in fact realized (though we have no expectation that the latter would prove to be the case).

20. **Do you believe your marketing efforts would result in greater commercial demand for STS than that resulting from the efforts of some competent marketing firm that NASA might hire?**

This question is, of course, hypothetical, and not conducive to response since it calls for General Space to compare its capabilities with those of an unnamed "competent firm." We are confident that, in any actual competition, General Space would compare favorably with other interested parties.

21. **What marketing expertise would you cite in responding to a NASA Request for Proposal?**

Again, it would be premature and would put General Space at a competitive disadvantage to disclose publicly its anticipated response to aspects of the NASA RFP in advance of its issuance. The company is fully prepared, however, to demonstrate its marketing expertise as part of that process.

22. **Under your proposed venture, would you expect the price of commercial payloads to be higher than that which the U.S. Government would set in the absence of private sector participation in STS? What is your response regarding the price to NASA, DOD, and other U.S. Government payloads?**

General Space, as marketing agent, would be obligated to pay the going NASA price for shuttle launch services, though it would expect to have limited pricing flexibility with its customers subject to NASA agreement. As for U.S. government payloads, the price, if any, would likely be the standard NASA price.

23. **It appears that your contemplated proposal would provide a guaranteed level of profitability for the lease side of the venture. Similarly, does your proposed venture contemplate a guaranteed minimum level of profitability on the marketing side?**

No.

24. **Would the marketing side of your venture derive revenues only from the increase in demand your marketing efforts would realize for STS above the demand which would accrue to STS anyway with a completely U.S. Government-funded 4 orbiter fleet?**

That is one of the scenarios discussed with NASA, though other customer services might be developed which would provide revenue beyond that envisioned in a marketing agreement.

25. **How would you compute the revenues you will derive from your marketing efforts?**

The method for computing the company's share of any revenues from our marketing activity is a point that would have to be negotiated with NASA. We would expect that the company's share would, however, be in the nature of an incentive payment, with the major portion of any additional launch revenues accruing to the government.

26. **Would you also act as a broker for insurance of payloads and financing of launch services? If so, to what extent would profitability of the total venture be associated with these brokerage services?**

It is not possible to say at this time which options, if any, General Space might wish to pursue regarding possible insurance brokerage services. As for the question of insurance generally, that has been discussed in our previous testimony.

27. **Would your proposal require "first right of refusal" for the subsequent lease or purchase of existing or future Orbiters?**

No.

28. **Would your proposal require exclusivity in any other form?**

The proposal does not envision exclusivity. However, the delegation of marketing responsibility would have to be sufficiently long-term to allow development of both a comprehensive program and a reasonable rate of return.

29. **What is the highest price Astrotech could pay for an Orbiter before it becomes an unprofitable venture to buy/lease the Orbiter with NASA?**

We cannot set a precise limit at this time. We are confident, though, that the final cost of an additional orbiter will be well within the financing capabilities of General Space under the terms we have outlined.

30. **If NASA were to give you marketing authority for government expendable launch vehicles, as well as the Shuttle, wouldn't that conflict with private sector ELV's?**

If General Space operated as the designated marketing agent for NASA launch services, it would compete with private sector ELV's only to the extent that the government made a decision to do so. We would note, though, that the shuttle was designed to provide the U.S. government with a means of competing effectively with all other launch systems, particularly those such as Ariane, which are operated by foreign governments.

PRIVATE FINANCING OF A SPACE SHUTTLE ORBITER - APPENDIX #2

NASA

National Aeronautics and
Space Administration

Washington, D.C.
20546

MAY 2 1986

Reply to Attn of C:MDD:C-18772f

Honorable Bill Nelson
Chairman
Subcommittee on Space Science
and Applications
Committee on Science
and Technology
House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

Enclosed are responses to written questions submitted by you during the March 19, 1986, hearing at which Mr. Gillam testified on private financing of a Space Shuttle orbiter.

This information completes the material requested during that hearing.

Sincerely,

Lynn W. Heninger
Director, Congressional Liaison Division

Enclosure

Questions submitted by Chairman Nelson during the March 19, 1986, hearing at which Mr. Gillam testified on private financing of a Space Shuttle orbiter.

QUESTION 1:

What motivated NASA to issue a Request for Expressions of Interest (January 1986) for financing a fifth Shuttle Orbiter.

a. What is the Agency's next step?

b. Has the situation changed as a result of the Challenger accident, or will NASA continue to pursue this?

ANSWER 1:

The July 1984 national space policy directs NASA to explore privatization of Government space activities. Further, the Grace Commission, in its report, called for further study of expanding legislation to allow private sector investment in space shuttles. Strong congressional interest in commercialization of space activities was made clear in the 1985 NASA Authorization Act which directed NASA to "...seek and encourage to the maximum extent possible, the fullest commercial use of space " In explaining the intent of this language, your Committee has encouraged NASA to "aggressively pursue all areas of potential commercialization." In addition, NASA received two unsolicited proposals for private sector funding of a fifth orbiter, one in 1982 and one in 1984.

In view of the clear Executive Branch, Legislative Branch, and private sector interest in pursuing areas of potential commercialization, the Office of Commercial Programs (OCP) published a Request for Expressions of Interest (REI) in the **Commerce Business Daily** on January 22, 1986, to determine the extent of private sector interest in financing of an orbiter. A total of four companies responded to the REI.

NASA will continue to assess private sector funding of an additional orbiter in the wake of the Challenger accident. We have formed a team to draft a Request for Proposal (RFP) and we expect to have a preliminary draft by the end of May.

QUESTION 2:

Can you please summarize the nature and extent of NASA's contact with Astrotech and General Space Corporation?

ANSWER 2:

Astrotech's subsidiary, General Space Corporation, responded to NASA's REI in private sector financing of a fifth Shuttle orbiter. In addition, Astrotech officials met with OCP staff to share their concept for such financing and left with OCP a brief "concept paper." Astrotech officials have met with the Acting Administrator on several occasions to brief him on their concept. In addition, General Space Corporation executives recently met with OCP personnel to discuss such general questions such as timing of the RFP which NASA is now drafting for private sector financing of an orbiter.

QUESTION 3:

What do you see as the major considerations involved in a lease back arrangement such as Mr. Rockwell has proposed?

a. Isn't any such agreement subject to the availability of appropriated funds?

ANSWER 3:

NASA has used six guidelines in the past to evaluate proposals on private sector financing of an orbiter. Any future proposals will be evaluated using these criteria. These criteria are:

a. Any agreement between the Government and a private sector proposer to purchase an orbiter must provide for the exercise of national security, rescue, or NASA priority missions;

b. The Government has made a major investment in the STS and the terms and conditions must appropriately recognize the investment and must contain methods by which the Government gains as each party shares appropriately in the risks associated with operations;

c. The private sector proposer would be making a major investment in extra STS fleet capacity and should have the potential for an appropriate profit over the lifetime of the investment. However, this appropriate return-on-investment must also not add to the price burden for Shuttle customers so that they seek alternate launches and eventually drive up the price to both Government and private users due to significant decreases in launch rates.

d. The prime requirement of the national STS is a safe and effective operation, and the private sector proposer would have to agree to an orbiter configuration which is safe and will meet overall STS fleet requirements;

e. An agreement between the Government and a private sector proposer for the purchase of an orbiter cannot be exclusive, without competition; or must maintain an option for other interested parties to purchase an orbiter on a similar or equal basis; and

f. Any final agreement between the Government and a private sector proposer for the purchase of an orbiter must be a public agreement, which is demonstrably in the Government's interest as well as meeting the legitimate needs of the proposer.

Under the current law, any such agreement which require appropriated funds would be subject to the availability of such funds.

In the concept currently being discussed by Mr. Rockwell, the lease feature is only one side of the venture . The other side of the venture includes a marketing arrangement. Accordingly, we include the following among the major considerations for NASA and the U. S. Government in analyzing any proposal based on this concept:

a. The level of true financial risk to be undertaken by the private sector on the lease side of the venture as well as on the venture overall.

b. The level of risk that the venture would require NASA and the U. S. Government to bear regarding such matters as insuring the private orbiter, termination liability, third-party liability, liability to customers of the private orbiter, compensation required by the proposer in the event of U. S. Government takeover of the private orbiter in times of national emergency.

c. The results of a cost/benefit analysis of the overall venture from the U. S. Treasury's perspective.

d. The ability of the proposer to increase commercial demand for STS above that which would accrue to STS anyway with a U. S. Government-funded 4-orbiter fleet, given either NASA marketing efforts or the efforts of some competent marketing firm that NASA could hire.

e. Resulting price to commercial payloads as well as U. S. Government payloads.

f. Exclusivity requirements of any type.

g. Whether the proposal contemplates providing private financing for 100 percent of the replacement cost of an orbiter (i.e., the most recent model, OV-104), including any cost overruns.

h. The proposed level of reimbursement to NASA for required NASA-provided services such as launch operations, flight operations, orbiter transport, repairs, maintenance, modifications, spares, propellants, and all items essential to safe and effective orbiter functioning.

i. The level of foreign investment in the venture.

j. Any proposed sharing in NASA's authority regarding scheduling and manifesting.

QUESTION 4:

In your opinion, has Astrotech presented a preliminary proposal that can be further considered by NASA?

a. What additional information will you need to begin "negotiations" with Astrotech?

ANSWER 4:

NASA's Request for Expressions of Interest was not a Request for Proposal. No proposals were requested nor were any submitted. Astrotech (General Space Corporation) submitted a "concept paper" which Mr. Rockwell elaborated on in his testimony of March 19, 1986. However, the "concept paper" does not constitute even a preliminary proposal for consideration.

NASA will not begin negotiations with any organization until an RFP has been approved and published, and responses received and evaluated.

QUESTION 5:

What benefits do you see to NASA and the country of a privately-funded Orbiter? What are the benefits to the private sector?

ANSWER 5:

A privately-funded orbiter would be a clear demonstration of commitment to the concept of private sector investment in space. Assuming that the agreement met the criteria which NASA has set forth to evaluate such proposals, the agreement would be demonstrably in the Nation's interest. The private sector would have the opportunity to make a major commercial investment in the space program and to receive a return on that investment and the Government would benefit by sharing appropriately in the benefits and by not having to fund upfront a project of this magnitude.

QUESTION 6:

The Challenger accident has given us pause to consider the reevaluation of the role of ELV's for Government and commercial launches.

a. Is your office currently looking at the commercial viability of ELV's?

b. Can you describe what considerations would be involved if the Government were to take steps toward private ownership of the Shuttle and give commercial ELV's a "kick start" at the same time?

ANSWER 6:

NASA hopes to see a healthy, viable, and competitive commercial ELV capability. OCP is currently exploring with Transpace Carriers, Incorporated, (TCI) the viability of their proposal for privatization of the Delta ELV. We are also assessing, as an agency, the draft proposal for privatization of the Atlas-Centaur which General Dynamics signed last fall. Following this review, we will transmit the draft to your Committee, and to the Senate Committee on Commerce, Science, and Transportation, for review.

Depending on the arrangements negotiated, it is possible that private sector involvement in financing an orbiter could compete, in some payload categories, with private sector ELV's. This is a factor which private sector proposers would definitely keep in mind in preparing their proposals. It would certainly be a factor NASA would be sensitive to in any negotiations resulting from current activities to privatize ELV's and obtain private sector financing of an orbiter.

QUESTION 7:

What advantages do you see in a private company serving as marketing agent for the Shuttle fleet? Disadvantages?

a. Do you believe a private marketing agent would enable the U.S. to compete against Ariane?

ANSWER 7:

NASA has marketed the STS fleet to commercial, DOD, and foreign customers for a number of years. This responsibility was successfully carried out before and after the creation of Arianespace, a quasi-commercial European expendable launch vehicle consortium. Certainly a private sector marketing agent willing to invest the resources required to obtain the necessary expertise in the STS, knowledge of the customer base, and familiarity with current and future competition can perform the STS marketing function. The major advantage of a private marketing agent would be the ability of that agent to provide a focused non-Government marketing effort with the intent and expectation of increased Shuttle use. Clearly, effective marketing could increase the ability of the United States to compete with Ariane.

The question becomes, however, the extent to which such an enterprise will be commercially successful and whether the Government will be required to guarantee a level of financial success of any such activity. However, success is not guaranteed, nor would an effort which required greatly increased prices for the user necessarily be competitive with prices Ariane could offer.

QUESTION 8:

What is meant in your guidelines for the private purchase of an Orbiter that:

a. The terms and conditions "...must contain methods by which the Government gains as each party shares appropriately in the risks...."

b. Such an agreement must be "...demonstrably in the Government's interest...."

ANSWER 8 a.:

The criteria that any such proposal "...must contain methods...." means that the U. S. Government gains must be clearly reflected by the results of the cost-benefit analysis of the venture from the U. S. Treasury's perspective. That is, the analysis must indicate that the arrangement is economically preferable to the U. S. Government financing an orbiter at Treasury-borrowing rates.

Each party sharing appropriately in the risk would require the private sector to bear significant, real financial risk. Accordingly, any explicit or implicit provisions for a guaranteed minimum return on investment is contrary to this criterion. The criterion would also preclude the shifting of all, or a disproportionate share, of the real financial risk associated with the venture to the U. S. Government. Accordingly, the private sector must be prepared to assume financial risk commensurate with expected returns.

ANSWER 8 b.:

That the venture is "demonstrably in the U. S. Government's interest" would be reflected (1) in the results of the cost-benefit analysis, and associated sensitivity analysis, regarding the venture's economic attractiveness relative to the U. S. Government financing an orbiter at Treasury-borrowing rates; and (2) by the types and levels of risk the U. S. Government would explicitly or implicitly be required to assume.

QUESTION 9:

If NASA gave marketing authority for Government ELV's to one private sector entity, would there be a potential conflict with other companies involved in privatization of ELV's?

ANSWER 9:

There certainly could be a potential conflict for non-Shuttle dependent payloads if NASA gave marketing authority for Government ELV's to one private sector entity while other private sector entities were attempting to privatize ELV's.

QUESTION 10:

Will the Request for Proposal (RFP) for a replacement Orbiter allow for new technology to be incorporated in the Shuttle design?

ANSWER 10:

We anticipate an RFP for private sector financing of an orbiter would assume the OV-104 configuration. However, this configuration should include any modifications resulting from the 51-L accident investigation. At this time, we are carefully studying what should be contained in the RFP. The issue of whether the RFP should allow for private sector financing of subsequent modifications is one that we are looking at most carefully.

QUESTION 11:

Will the criteria you stated for evaluation of past private sector proposals for purchase of an Orbiter be the same criteria used to evaluate proposals received in response to the RFP or will they have to be modified?

ANSWER 11:

The six criteria used for evaluation of past private sector proposals were published in the REI on January 22, 1986. These same criteria will be applied to responses which might be received as a result of an RFP.

PRIVATE FINANCING OF A SPACE SHUTTLE ORBITER - APPENDIX #3

TRANSPACE CARRIERS, INC. RESPONSES TO SPACE SCIENCE AND APPLICATIONS SUBCOMMITTEE APRIL 1, 1986 QUESTIONS

Transpace Carriers, Inc. ("TCI") is pleased to respond to the following additional questions of the House of Representatives Subcommittee on Space Science and Applications.

1. Please provide background on your technical as well as financial standing which will enable you to become a viable commercialization operator of Delta. Will you use international financing?

TECHNICAL BACKGROUND INFORMATION

SUMMARY: TCI was formed by several former NASA Delta Project personnel at the time that it was announced that the Government would terminate its Delta operations after the completion of the remaining flight schedule. The Company's founders believed that there would be a good commercial market for future Delta launch services due to the vehicle's exceptionally high reliability, its flexibility both in scheduling to satisfy customer desires and in providing cost-effective launch vehicle services to a broad range of payload weights, its single satellite dedicated mission service, its insurability, and its potential for continued growth to meet customer requirements for larger satellites and associated launch services. Due to the excellent results that had been achieved by the management structure of NASA's Delta Project and the intimate familiarity of the founders with that structure, it was decided to model TCI's management structure and practices as closely as possible upon those of the Delta Project in order to take advantage of the strengths of that structure and to provide a smooth continuum of operations from Government to private sector operation of the Delta. The same general management structure would be maintained, adding only those functions necessary for a commercial operation (such as advertising, marketing and finance), and the same team of contractors would continue to build and launch the Delta using the same equipment, facilities, personnel, practices and procedures, and the same reliability and quality assurance standards that had been used by the Delta Project. The Company's operations would be financed principally through customer payments for services (the Delta Project had been virtually self-supporting by requiring customers to pay their full share of all costs related to their launch), with additional initial capital supplied by investors to cover the front-end costs of establishing a commercial Delta launch services operation.

PERSONNEL: TCI will be managed and staffed by many of the same people that successfully managed the NASA Delta Project for many years. Among those people already employed by TCI are the following:

David W. Grimes - NASA Delta Project Manager, 1977 - 1982. Responsible for all aspects of managing the Delta Project, including all technical aspects of vehicle preparation and launch, all customer service functions, and all financial and management aspects of a $200 Million per year operation. Previous NASA experience included serving as Project Manager for Shuttle Payloads, Project Manager for the Atmosphere Explorer Program, and Systems Manager for the Orbiting Geophysical Observatory Program. During his term as Project Manager, the Delta achieved thirty (30) straight successful launches following the recovery operation and program restructuring instituted by Mr. Grimes after the failure of Delta 134.

Merland L. Moseson - NASA Director of Flight Assurance, Goddard Space Flight Center, 1966 - 1981. Responsible for the complete technical review of the Delta vehicle prior to launch, held the authority to independently stop the launch if all technical aspects were not satisfactory. Also responsible for progress reviews of the vehicle during its production and launch preparation phases. Chaired or served on most of the launch failure review boards of the past two decades for all types of ELV failures.

George W. Hinshelwood - NASA Deputy Director of Flight Assurance, 1981, and Chief of Systems Review Division, Goddard Space Flight Center, 1966 - 1980. Served for more than 21 years in technical management and flight assurance assignments for all GSFC spacecraft and launch vehicle missions and served for more than 10 years as a key member of the independent Delta Vehicle Review Committee, during which time he chaired several Delta Flight Readiness Reviews. Responsible for review of the technical adequacy and flight worthiness of the Delta Vehicle hardware systems and related reliability and quality assurance. Served on numerous failure review boards investigating the causes of various ELV launch failures, and responsible for numerous recommendations to improve manufacturing and launch operations. Following his assignments at Goddard, he served in the Office of the Chief Engineer of NASA, where he was responsible for the day-to-day operations of the NASA-wide Reliability and Quality Assurance Program.

Earl A. Reese - NASA Deputy Delta Project Manager for Resources, 1978 - 1979. Responsible for all financial management and administrative activities of the Delta Project, including budgeting, scheduling and negotiating production and launch services contracts. Following his service with the Delta Project, he was Assistant Executive Officer in the Office of the Administrator and Assistant Director for Management of the Tracking and Data Relay Satellite System.

Robert W. McIntyre - NASA Manager of Liquid Propulsion for the Delta Project, 1974 - 1983. Responsible for all aspects of engineering management for the liquid fuel engines on the Delta, including oversight of contractor manufacturing operations and quality assurance and reliability verification. Later served as Senior Program Manager for Production of SSME's.

In addition to the above personnel, several additional senior individuals still associated with the NASA Delta Project are committed to joining TCI either in the very near future or upon the completion of the currently scheduled NASA Delta launches. For obvious reasons, these people cannot be further identified, but they will provide the Company with personnel highly experienced in all phases of Delta production and launch operations.

This core of former NASA personnel will be augmented by senior personnel predominantly from the aerospace industry to provide the skills necessary for commercial operations and to provide services that are no longer available through Government personnel.

DELTA INDUSTRIAL TEAM: The Delta Industrial Team, composed of the McDonnell Douglas Astronautics Company (principal contractor and vehicle integrator), Morton Thiokol, Inc. (thrust augmentation motors and third stage motors), the Rocketdyne Division of Rockwell International (main engines), and the Aerojet TechSystems Company (second stage engines) has been in place producing and launching Delta vehicles for NASA for many years. All of these contractors have indicated that they will support TCI's commercial Delta operations just as they have supported the NASA Delta Project. They will continue to produce and launch Delta vehicles for TCI using the same equipment, facilities, personnel, practices and procedures, and standards of quality assurance and reliability verification that have proved so successful.

TECHNICAL OPERATIONS PLAN: TCI's plans for managing the technical operations of the commercial Delta program build upon the extensive experience of its personnel in the NASA Delta Project and the retention of the intact Delta Industrial Team to continue to operate Delta launch services operations in essentialy the same manner as the NASA Delta Project managed its operations. While certain aspects of financial and administrative management will have to be structured differently that they were at NASA to operate efficiently in a commercial environment, the practices and procedures for technical operations can be transferred to a commercial setting with only a minimum of changes. In particular, the members of the Delta Industrial Team will continue to manufacture, checkout, store, transport and launch the vehicle as they have in the past, and TCI will insure that an independent quality assurance and reliability verification organization manages the reliability and quality assurance programs at each of the members' facilities, using the same high standards that were employed by the Defense Contract Administrative Service on behalf of NASA. The TCI Quality Assurance & Reliability program will be headed by Mr. Hinshelwood, who performed a similar function while at NASA, and will include continuous monitoring of contractor operations to insure that each vehicle meets or exceeds all technical specifications and requirements. TCI will also subject each vehicle to review by an independent Flight Readiness Review Board headed by Mr. Moseson, who will have the authority to stop any launch if it appears that there is the slightest chance that the vehicle is not 100% ready for launch. Any decision to commit a vehicle to launch will require the independent concurrence of the TCI Director of Launch Operations, the Customer Mission Manager, and Mr. Moseson, any one of whom will be able to stop the launch if they are not satisfied that everything is ready for launch.

TCI's technical staff will also operate in conjunction with the members of the Delta Industrial Team to develop and implement vehicle improvements in the same manner as NASA had operated. Increases in vehicle performance, changes in operating practices and procedures, and reliability and quality assurance modifications will all be handled in accordance with the established procedures of the Delta Project. In the event there should ever be a launch failure, the evaluation and recovery from such a failure will be managed in the same manner as NASA handled similar situations.

FINANCIAL BACKGROUND

TCI is currently a privately held corporation organized under the laws of the State of Maryland. TCI has financed its start-up operations to date from a combination of private placements of equity and debt to a number of private investors and financial institutes, expending approximately $6 Million to date.

TCI has developed and refined a business plan, through numerous consultations with experts in the field of aerospace operations and with major financial institutions such as Citibank and the Bank of America, that will be completely sustained by customer progress payments following a brief period (approximately two years) when additional capital must be committed to fund the start-up costs of production operations. TCI plans to fund this initial capital requirement from a combination of a public offering during the late Spring or Summer of 1986 and further private placements of debt and equity. TCI's underwriter for the initial public offering is the New York firm of McKinley Allsopp, Inc., and TCI is working with a number of investors to conclude the additional private placement(s). McKinley Allsopp's parent, MerchantsBank of Boston, has provided NASA with a $5 Million Guaranty Agreement that will indemnify NASA from any and all financial liability that may arise from TCI's termination of its Delta production operations after they have commenced.

As a privately held corporation, TCI believes that 100% of its stock is owned by United States citizens. At the time TCI places its initial public offering, it will be impossible to assure that all of the offered stock is purchased by United States citizens, but there are no plans to seek foreign participation or to advertise the offering in foreign countries.

2. Specifically describe your current marketing efforts and your assessment of the potential of capturing domestic and foreign business. Indicate specifically who the customers are and when they need to fly and TCI's ability to meet their requirements.

We have approached all known potential users of the Delta ELV and have identified 24 launch requirements through 1989. Arianespace, the French launch services company, will be able to accomodate only 4-8 of these payloads, and the STS will have a backlog at that time of over 50 payloads. TCI's best prospects for near term launches are: American Satellite, Western Union, Indonesia, India, and RCA, all of whom need launches either in 1987 or early 1988. Specific launch services proposals have been sent or will very shortly be sent to all of the potential near term launch prospects.

TCI's ability to capture sales to any of these customers is directly dependent upon the use of residual hardware and long-lead materials for Delta vehicles 182 - 192. All of this hardware and long-lead materials were to have been turned over to TCI as part of the signed Delta Commercialization Agreement between NASA and TCI, but a requirement on the part of the Strategic Defense Initiative Office for some Delta hardware led NASA to request that TCI accept a modification to this agreement and give up its rights to some of this hardware in order to satisfy the SDIO requirement. TCI agreed that, in the interests of national security, it would release its rights to those specific items of hardware and materials that were necessary to satisfy the stated SDIO requirement, but TCI retained its rights to all other items of hardware and long-lead materials. TCI believes that the SDIO requirements have now been clearly defined and that there is no reason to prevent the use of all the items of hardware and long-lead materials that are not so required.

With the use of these items, TCI has verified with its contractors that it can have its first vehicle prepared for launch in November 1987, its second in late December 1987, and one more vehicle in each of the calendar quarters of 1988. Without use of this hardware, TCI's first launch opportunity would be in the first quarter of 1990. Failure to release the hardware would drive TCI's costs up by approximately $100 Million over the next two years and would require TCI to price its launches so high (in order to recover this additional expense) that it would be very difficult for TCI to commercialize the system.

3. What commitments do you have with Delta contractors and suppliers?

TCI has stayed in contact with all of the members of the Delta Industrial Team, and has obtained letters from the three principal Delta suppliers (McDonnell Douglas Astronautics Company, Rocketdyne Division of Rockwell International, and Huntsville Division of Morton Thiokol) stating their commitment to supply to TCI Delta components and services as needed for TCI's Delta operations. TCI has essentially completed the negotiations for the terms and conditions of production contracts with each of these three contractors, and the major element remaining before signature of such contracts is a current price quotation. TCI has requested updated pricing proposals, and these proposals will provide a basis for negotiating the final production agreements.

4. What is the initial outlay required for establishing a commercial capability for Delta ELV's?

It will cost approximately $10M in non-recurring cost to reestablish the Delta production line and requalify suppliers. TCI has plans for Delta improvements which will require expenditures in the next few years of between $30-35M.

5. What is your plan to finance that outlay? Are you planning a public stock offering and, if so, when?

6. What are your sources for financing your startup operation of a commercial Delta capability? Please identify them specifically.

There are several sources of financing available to TCI. TCI has engaged McKinley Allsopp, Inc., a New York investment bank, to publicly offer TCI's securities. Both TCI and its underwriter believe that, given present market conditions, it is a propitious time to accomplish such a registered public offering. The underwriters have stated, however, that it is critical to any successful public offering that TCI and NASA enter into a final Commercialization Agreement prior to the filing of the registration statement. The first draft of this registration statement has been completed and is being reviewed by the appropriate parties.

In addition to the proposed public offering, TCI has continued to identify large institutions, including several industrial companies, which would be interested in a substantial investment. Currently TCI is operating largely on short term debt "bridge" financing provided by individual and institutional investors pending either the completion of a registered public offering or the closing of a private placement of the TCI's debt, equity or both.

7. How much financing have you raised to date? How much do you anticipate raising and on what schedule?

To date, expenditures of approximately $6 Million have been funded through private placements of debt and equity. An additional $5 Million has been committed by MerchantsBank of Boston in the form of a Guaranty Agreement with NASA to indemnify NASA from any financial liability that may arise from TCI's termination of its Delta production operations after they have commenced.

TCI anticipates a public offering of approximately $30 Million in equity securities and $50 Million in debt securities. It is anticipated that this initial public offering will be made in the late Spring or early Summer of 1986. TCI is currently discussing a large private placement of bridge capital with several potential investors that would be available to the Company in the very near future. These sensitive discussions are ongoing.

8. Will you be able to obtain insurance necessary for commercial operations? From whom?

TCI has had a number of discussions with potential insurance providers concerning all of the various types of insurance that it would be advisable to have in order to proceed with its planned Delta operations, including third party launch liability insurance. Based on these discussions, TCI is confident that it will be able to obtain all of the insurance that it desires. TCI's main discussions have been with Alexander & Alexander and Marsh & McLennan. The current deterioration of the ability to obtain any form of liability insurance in the marketplace, however, is of concern to TCI as well as any other business organization.

NASA

National Aeronautics and
Space Administration

Washington, D.C.
20546

PRIVATE FINANCING OF A SPACE SHUTTLE
ORBITER - APPENDIX #4

Reply to Attn of: G

June 24, 1986

Honorable Bill Nelson
Chairman
Subcommittee on Space Science
  and Applications
Committee on Science and Technology
House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

You have requested an analysis of the legal authority for NASA to enter into a private financing agreement, such as a lease or sale/lease-back, for a replacement Space Shuttle orbiter.

NASA's ability to enter agreements under the National Aeronautics and Space Act of 1958, as amended (Space Act), is very broad. This enabling legislation, in section 203(c)(5), authorizes NASA to enter and perform, without regard to the normal provisions barring advance payments (31 U.S.C. 3324), "such contracts, leases, cooperative agreements, or other transactions as may be necessary in the conduct of its work and on such terms as it may deem appropriate...with any person, firm, association, corporation, or educational institution." While this authority is very broad, it must be read in light of the Armed Services Procurement Act, 10 U.S.C. Chapter 137, to which NASA is expressly made subject in section 301(b) of the Space Act, as well as broad, government-wide requirements such as the Anti-Deficiency Act (31 U.S.C. 1341) and other, basic provisions concerning general programmatic authority.

In practice, the section 203(c)(5) authority has not been interpreted or used in derogation of the basic procurement statutes. Therefore, before appropriated funds pass to a party under a NASA agreement, all statutory and regulatory requirements are met. When appropriated funds are not expended, however, the use of our Space Act authority becomes more common. Examples of Space Act agreements would be Launch Service Agreements, Joint Endeavor Agreements, Technical Exchange Agreements, and the like.

In other words, before we could determine exactly what legislative authority would be needed to permit an agreement for the private financing of a replacement orbiter, we would have to know what type of arrangement was being proposed. If the proposal were for a lease or sale and lease-back, those proposals would require the eventual expenditure of appropriated funds and our current authority would not be sufficient to proceed. That type of arrangement would be essentially similar to the purchase of TDRSS services, and I see no basis for argument that the needed legislative authority would be less for a replacement orbiter than it was for TDRSS.

There are other possible proposals, however. One could envision a party offering to furnish a privately financed orbiter in return not for appropriated funds, but for the opportunity to sell an orbiter's launch capacity to the world market and have the orbiter operated as part of the NASA fleet. If such a proposal were received, it could be possible that no procurement or demand for appropriated funds would result. In that case, and I make no assessment of the practicality of this or any other approach, NASA's current legal authority may well be sufficient to proceed. Despite the possibility that NASA may have sufficient legislative authority to enter some type of agreement for a replacement orbiter, it is clear that such an agreement would be highly unusual, innovative, and involve very large sums of private capital. Therefore, prior to entering such an arrangement, Administration and Congressional concurrence would be obtained by NASA.

In our efforts to comply with the sense of Congress, as expressed in section 107 of H.R. 4691, NASA is preparing a draft solicitation of proposals for a privately financed orbiter. In that solicitation, which is almost ready for its initial release for industry comment, it is made very clear that NASA may need some additional legislative authority to enter into any such agreement and that no agreement will be entered until NASA authority is confirmed. The statement is also made that any proposed agreement will be reviewed by the Administration and our Congressional committees and that an agreement will be entered only if there is a consensus that the agreement "is an equitable agreement in the public interest."

I hope that this information answers your question and indicates NASA's sensitivity to the need for appropriate legislative authority for and approval of any privately financed orbiter proposal. We look forward to receiving industry's comments to our draft solicitation and working with industry, Congress, and the Administration to determine the feasibility of this innovative concept. If you have any further questions on this matter, please do not hesitate to contact me.

Sincerely,

John E. O'Brien

John E. O'Brien
General Counsel

PAYLOAD PRIORITIES - APPENDIX #1

REQUIREMENTS FOR A U.S. EXPENDABLE LAUNCH VEHICLE CAPABILITY

Report of a Workshop
June 25-27, 1986
Airlie House
Airlie, Virginia

Convened at the Request of

Committee on Science and Technology
U.S. House of Representatives

by

Public Policy Committee
American Institute of Aeronautics and Astronautics

Report Prepared by

John M. Logsdon
Vice-Chairman, Public Policy Committee

I. Background

On May 20, 1986, Chairman Don Fuqua of the House Committee on Science and Technology asked Vice President for Public Policy John Clark of the American Institute of Aeronautics and Astronautics (AIAA) to bring together "concerned private parties" in order "to discuss the feasibility of developing a truly viable, commercial, and competitive United States ELV [expendable launch vehicle] industry." Chairman Fuqua expressed the hope "that such an AIAA forum would bring together ELV manufacturers, commercial satellite manufacturers and owners/operators, other users of launch services (such as scientists), upper stage manufacturers, representatives from the financial and insurance communities, as well as other appropriate representatives from the space community."*

In response to this request, AIAA organized a June 25-27 workshop under the auspices of its Public Policy Committee; the workshop was held at Airlie House, a conference facility near Washington, D.C. Each of the groups identified in the Congressional request except for the scientific community was represented by at least two of the thirty-two participants.** An agenda for the workshop and a list of participants and Congressional observers are included as Attachments B and C.

The workshop began on Wednesday evening, June 25, with an off-the-record briefing and discussion on Executive Branch thinking regarding the restoration of U.S. launch capabilities. Participating in the briefing were:***

Col. Gerald May, National Security Council

Mr. Jerry Fitts, Deputy Director
Office of Customer Services
Office of Space Flight, NASA

Ms. Madeline Johnson, Director
Office of Commercial Space Transportation
Department of Transportation

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*A copy of Rep. Fuqua's request is included as Attachment A.

**Representatives of the scientific community were invited to the workshop but could not attend. It should be noted that space users interested in low-earth orbit operations (e.g., space manufacturing, remote sensing) and/or requiring human involvement with payloads were not represented at the workshop, nor was the shuttle manufacturer. Thus the discussion was not representative of the interests of all sectors involved in space.

***The Department of Commerce was scheduled to participate in this briefing but its representative did not appear.

On June 26 and 27, the workshop was devoted to a free-flowing, often intense, discussion of the many aspects of the central question posed by Chairman Fuqua: "the feasibility of developing a truly viable, commercial, and competitive United States ELV industry." Formal presentations by participants were kept to a minimum, although several participants contributed position papers for consideration by the workshop. Those position papers are referenced in the following summary of the workshop discussion and are included as Attachments D through J. All discussions were conducted on a not-for-attribution basis; thus this report does not associate individual workshop participants with particular statements or points of view.

A particular focus of the workshop was identifying potential policy options for Congress related to creating a viable U.S. ELV capability and obtaining the views of participants regarding those options. There was no attempt to create a consensus with respect to any particular policy option, and this report reflects the wide diversity of opinions voiced with respect to most of the options or proposals considered by the workshop. There was, however, general agreement among workshop participants on a few propositions, and that agreement is also reflected in this report.

This report was prepared by Dr. John Logsdon of George Washington University, Vice-Chairman of the Public Policy Committee, who also chaired the workshop. A draft of the report was made available to each of the workshop participants, and their comments have been incorporated to the extent feasible. The report is intended as an accurate summary of the actual workshop discussions, and does not necessarily represent the views of the AIAA or of any individual participating in the workshop.

II. Areas of General Agreement

Although a wide variety of views were expressed on most of the specific policy options considered by the workshop, a few propositions did command widespread (although not necessarily unanimous) support among the participants. Among these were:

1. Highest national priority should be given to reconstituting a U.S. government launch capability based on a mixed fleet of shuttles and ELVs. Getting both shuttles and ELVs available for U.S. users is the central issue. To be avoided is dependence on any one launch system for U.S. access to space.

2. Government policy should be designed so that ELVs can serve as the primary launch systems for current commercial and foreign payloads going beyond low earth orbit. In particular, a policy that creates no artificial incentive for commercial and foreign users to prefer the shuttle to ELVs should be developed.

3. Even when preference is given to ELVs as launch systems, satellite owners/operators want the shuttle available as an alternate launcher in the event that an appropriate ELV is not available.

4. In the short-run, creating a viable U.S. expendable launch capability will require some degree of government involvement. Recent decisions by the Department of Defense to procure both large- and medium-size ELVs for its own use and by NASA to offer ELV launches as an alternative to the shuttle go a long way towards meeting that requirement, since such federal procurements assure the existence of ELV production lines and the active use of launch teams and facilities. Many of the participants added that one major element still missing is a clear and appropriate policy regarding shuttle use and price. Most also believed that continuing government support of the research and development needed for future launch systems will also be required.

5. Given appropriate government support such as that just described, some U.S. expendable launch vehicle manufacturers believe that they can compete in the world market for launch service contracts.

6. A commercial ELV industry is not possible unless the government completes and honors agreements with private sector ELV operators regarding hardware transfer, terms of access to launch facilities and launch ranges, etc. These agreements have been in process for some time. High priority ought to be given to completing them, if the policy of the federal government continues to be creating the environment within which a commercial launch vehicle industry can operate.

7. A decision on whether to develop a fourth orbiter should be based on shuttle unique mission requirements, not on the basis of reducing the backlog of commercial and foreign payloads that can be launched on ELVs as well as shuttles.

8. There is an urgency to most of the above. The sooner a positive policy framework is put in place, the better.

Those that did not agree with the general thrust of these points based their dissent on two major arguments:

1. Any policy that depends on current ELV designs or their derivatives meet short-to-medium-term U.S. launch requirements is likely to stifle technological innovation aimed at lowering transportation costs and/or increasing reliability, particularly on the part of new firms wishing to enter the space transportation business.

2. A policy that limits the use of space shuttle to shuttle-unique payloads and a backup role for other launches will delay or prevent the shuttle from becoming a mature system, might deny users less expensive launch prices based on the real costs of providing them excess shuttle capacity, and could damage irreparably the prospects of those commercial firms that have made shuttle-dependent inevestments.

III. Policy Options Discussed

The workshop paid particular attention to potential government actions in three areas:

A. the general policy framework for providing U.S. launch services;

B. means for providing insurance for space activities; and

C. means for ensuring the reliability of launch systems.

Each of these three areas is discussed below.

A. Framework for Providing Launch Services

Most of the workshop was devoted to discussions on this issue. Four options received particular attention:

1. a user-oriented policy framework dealing with all aspects of commercial launches, with NASA aggregating the market, procuring ELVs, and providing launch services;

2. a return to a "pre-shuttle" situation in which NASA provided most U.S. launch services for civilian payloads using a mixture of launch vehicles;

3. competition within a favorable policy framework to provide launch services on a commercial basis;

4. creating a new National Launch Service Company.

Again, each of these options is discussed in more detail below.

A.1 - User-Oriented Policy Framework for Launch Services

A spontaneously formed ad-hoc group of the representatives of communications satellite manufacturers, owners, and operators met during the workshop and developed a collective statement of launch service requirements from their business perspectives. That statement included the following elements:

a. General Requirements

- price competition among launch suppliers, both U.S. and foreign;
- ability to contract at a fixed price for a specific launch date;
- a range of payload capabilities to meet satellite requirements equivalent to the upper and lower positions of Ariane 4;
- high reliability;
- guaranteed launch insurance availability.

b. Near-Term (1986-1992) Launch Program

- NASA buying enough ELVs through competitive procurements to meet projected 5-6 year requirements for both civil government and commercial launches;

- NASA to fund the upgrades/R&D required to provide U.S. mixed fleet compatibility and to compete with Ariane 4. Policy for use of the U.S. mixed fleet should include shuttle back-up availability for commercial and foreign launches (although the preference at equivalent prices is for ELV launches);

- a policy on pricing and availability based on incremental cost recovery at fixed prices for specific launch dates;

- government to create the environment or to take other actions to guarantee availability of insurance, at rates reflecting historical U.S. launch vehicle reliability;

- government to honor existing contractual commitments on the STS, if possible;

- government to establish a launch priority system and to live by it.

c. Long-Term (post-1992) Launch Program

- pursue commercialization of U.S. ELV services that meet the user requirements outlined above.

These propositions seem to have reflected an amalgamation of the individual positions of several owners/operators that had been prepared in advance of (and not necessarily for) the workshop; those positions were represented in several papers that are included as part of this summary: RCA American Communications (Attachment E), Ford Aerospace Satellite Services Corporation (Attachment F), MCI Telecommunications Corporation (Attachment G), and Hughes Aircraft Company (Attachment H).

Most reactions to the position of the owners/operators centered around the role of NASA in providing all U.S. launch services over the next 5-6 years. In particular, there were two major concerns. One was the budgetary implication of NASA placing an advance order for launch vehicles against anticipated requirements. While the suggested pricing policy and progress payments would ultimately fully reimburse the government for the costs of providing ELVs to non-government users, there seemed to be no way of avoiding short-term NASA funding increases that may be politically unacceptable.

A second concern, one that applies to any option that puts NASA in charge of providing launch services for the country, is that NASA's behavior in recent years (and, in the view of some participants, even since the Challenger accident), has given no basis for confidence that the ELVs that launch customers prefer will be made available by NASA on an assured schedule and at an assured price. Too many non-business factors are involved when an agency as "political" as NASA gets involved in providing a service to commercial users. Thus an option that puts NASA in control of all or most U.S. launchers for the next few years was thought to be desirable only if the agency was working within an appropriate policy framework that was not only articulated but implemented.

The principal retort to this concern was that putting NASA in charge of the total U.S. civilian launch fleet may indeed not be an ideal situation in the abstract, but in practice is the one most likely both to be politically acceptable and to provide ELVs for commercial users as soon as possible. Two of the three ELV manufacturers present disagreed with this view, saying that there was no need for such extensive government involvement and that they were able to contract for launch services directly with commercial users, if only government policy provided a congenial framework for such commercial transactions. However, one ELV manufacturer suggested that creating a stable situation regarding launch vehicle availability by the most rapid means possible should have priority over commercial interests. His colleagues agreed that competitive government procurement of ELVs was in fact an acceptable business alternative to purely commercial activity, but they remained concerned whether such an approach was politically and budgetarily acceptable.

It was also pointed out that the scientific community wanted access to ELVs for its payloads, and had declared that a purely commercial approach to such access was not an adequate response (since the costs of launch services might then have to come from the science budget). Thus a situation in which NASA was the operator of a U.S. mixed fleet was likely to be attractive to space scientists. Indeed, if NASA were effective in its role as manager of a truly mixed launch fleet of ELVs and shuttles based on a stable and well-conceived policy, it could effectively compete with any non-U.S. provider of launch services. An important question, though, is whether a NASA, with a primary R&D mission, can or should undertake such an operational role in international political/economic competition, or whether this is more properly a role for commercial or quasi-commercial entities.

There was disagreement among participants about the significance and character of foreign competition as a variable influencing U.S. policy choices. Many, while acknowledging the technical quality and marketing skill of European competition, suggested that it was unlikely that Europe would make the investments required to expand significantly the availability of Ariane launches. Given a reasonable demand for launch services (and there was significant disagreement among participants regarding how great that demand would be in the long run, but relative agreement that the 5-6 year backlog of payloads would exceed Ariane's availability), this means that there will be a market for ELVs other than Ariane. In that sense, participants argued that foreign competition should not be a major variable in determining short-term responses to the current situation. One participant suggested that foreign competition was "more an emotional problem" than a reality. The other non-U.S. alternatives available, such as PRC or Soviet launch vehicles, were last resorts in the view of most participants; however, once the Japanese H-II vehicle was available, it was likely to be a formidable competitor, at least on technical grounds.

One way in which foreign competition *is* an important consideration was pointed out by several participants. If the United States desires to maintain (or regain) its position of world leadership in space, it must have a launch fleet that is superior to that provided by other spacefaring countries. In this sense, it was argued, a U.S. mixed fleet that effectively combined renewed STS capability and a variety of ELVs suitable for different payloads was something that no other country was likely to possess, at least for several years.

Another concern that pervaded much of the discussion of this and other policy alternatives was the priority for non-government payloads of access to payload processing and launch facilities, if the government provided all launch services. Commercial owners/operators suggested that using ELVs that depended on government-controlled facilities presented real schedule and cost risks unless some system of priority setting and charging policy that was acceptable to all users of space was developed and adhered to. How national security priorities would affect launch schedules was of particular concern.

A.2 - NASA as Launch Service Provider

The general framework discussed in A.1 incorporated some aspects of a policy option that had been separately suggested by several participants. Noting that "politics is the art of the possible" and that "now was not the time to experiment with untried approaches," these individuals proposed a policy option that would get the country from the current situation to a mixed national launch fleet as quickly as possible. An essential element of this approach was a national policy decision that the country would indeed have a mixed fleet. Perhaps, it was suggested, nothing else is required. For then:

a. DOD, NASA, and other government agencies could go about their traditional policy of obtaining the mixture of launch vehicles they require; this would provide a base of ELV production lines.

b. Government would pay the basic costs of restarting production lines, upgrading launch vehicles, and operating, maintaining, and upgrading launch facilities and ranges.

c. Commercial users would pay only the incremental costs of procuring and launching the additional vehicles or services they require.

d. Shuttle and ELV launch costs would be treated on an equivalent basis; since full incremental costs would be paid, there would be no additional costs to the government.

e. Users other than DOD would reimburse NASA, on a "milestone" basis, for the incremental costs for which they are responsible.

f. Nothing in this approach, it was claimed, would make it impossible for individual firms to develop new launch vehicles and to sell them to the government or individual customers or to develop new launch facilities and ranges.

Advantages of such a scheme, it was argued, could include increased reliability and economies of scale. Also, it provided the most predictable way of regaining a U.S. ELV capability. NASA, if relieved of a compulsion to justify the shuttle in terms of cost recovery, would be motivated to foster the flexible, equitable, and efficient use of all of the nation's launch assets. What is required is an appropriate management and costing structure, somewhat as the country had before the decision to put all payloads on the shuttle. This, it was argued, was a "tried and true approach" that would not require "plowing any new ground." (It was pointed out, however, that it was in times of stress like the current period that most organizational creativity can occur.)

Major objections to this approach were mistrust of NASA as manager of the nation's operational launch capability, as discussed earlier in this report, and a belief that NASA should not take on a role that could be performed on a commercial basis. Some also disagreed with the contention that this approach would not deter new entries in providing launch services.

A.3 - A Commercial Launch Service Industry

Each of the other three options for providing an ELV capability discussed in this report received focused attention during the workshop. The notion that the basis existed for a commercial ELV industry, however, was a thread that ran throughout the workshop. The basic proposition put forth by the ELV manufacturers was that most of the elements for a viable commercial industry existed, but that there was a major barrier to their being able to quote a specific price and launch date for a particular launch service. This was the absence of assurance from the government that it would not compete with the private sector for launch services contracts and that it would cooperate in providing launch and range facilities on acceptable terms. The manufacturers noted that recent Department of Defense decisions regarding the procurement of large and medium-sized expendable launch vehicles was a major step toward making ELVs available for the country. They also suggested that, given an appropriate policy climate, industry is willing to make the investments needed to modify launchers being developed for DOD and NASA to the requirements of commercial users. Their belief was that, given an appropriate government policy framework, they could be competitive with Ariane, at least at the current price level for Ariane launches. Most owners/operators felt that such a price level was still low enough for them to remain competitive with other communication means, particularly fiber optics.

Most questioning of the commercial ELV option focused on its prospects for viability at a time when there is a pressing national need for access to ELVs, when competition from Ariane is strong, and when long-term commercial demand for launches to geostationary orbit is uncertain. Some participants wondered whether in this situation, a sufficiently certain basis for a commercial industry over the medium-to-long term did in fact exist. (One of the manufacturers' response was that DOD procurements of ELVs had significantly reduced the risk of business failure.) The issue of whether attempts at commercialization should be postponed until the short-term launch crunch was eased by NASA procurement of ELVs was raised at several points during the discussion, and not resolved. Participants were divided on whether the risks of taking an "untried" commercialization approach at this time were acceptable.

The relationship between the shuttle and ELVs was another area of particular concern. Almost all participants agreed that NASA, in its desire to meet shuttle cost recovery goals set by national policy, had been largely successful in preventing the implementation of the 1983 Presidential decision to stimulate a commercial ELV industry. Many were unconvinced that, in the absence of a strong and specific national policy that set the conditions and prices under which the shuttle would be used for commercial launches, NASA would modify its attitude towards shuttle competition with ELVs. ELV manufacturers stressed repeatedly that they were unlikely to make the investments required to enter commercial business if there were a possibility of the shuttle reappearing in the 1990s as a competitor, at a subsidized price, for launch service contracts.

Most satellite owners, operators, and manufacturers expressed their preference for ELVs as the launch vehicle of choice, but were equally insistent that they did not want to be barred by policy from access to the shuttle as an alternate launch vehicle. This suggested, they felt, the need for a carefully crafted policy that provided no artificial incentives, economic or otherwise, to prefer the shuttle, that assured that the government would indeed cooperate as needed with commercial launch service providers, and that still maintained the shuttle as a "backup" launcher should U.S. ELVs not be available at the desired time or price. How a commercial ELV industry would relate to a government-controlled shuttle in such a backup role was of concern to some participants. This question raised the prospects for commercialization of the STS as well as ELVs. This issue was not fully discussed, but participants who offered opinions were skeptical of those prospects.

There was also some discussion of the potential for a consortium of launch service users to aggregate the demand for one or more ELVs. Such aggregated demand, some suggested, would create a market that would make it more feasible for a commercial ELV industry to develop, and could offer economies of scale and other benefits to the purchasers of launch services.

The issue of access to launch facilities and ranges was raised with respect to commercial ELVs. One area in which the 1983 decision to encourage ELV commercialization has not been implemented is in completing agreements between commercial launch firms and the government regarding terms and conditions for access to government launch facilities. Those commercialization agreements have been in the government's hands for signature for some time. All agreed that such agreements, and a priority-setting system that provided adequate assurance to commercial launch service customers that their interests would be protected, were essential elements of any viable commercial launch business. The government's sluggishness in completing such agreements was seen by some as an example of its bad faith on the commercial ELV issue; yet goodwill between the private sector and government, not bad faith, is critical to creating a commercial ELV industry.

A.4. - National Launch Service Company

One participant brought to the workshop a proposal for a National Launch Service Company; that proposal is included as Attachment I. The company was described as a "U.S. Arianespace," focused on aggregating, marketing, and providing launch services, not on hardware development (at least initially). Its essential features include:

1. owners of the company would include the U.S. government, launch vehicle suppliers, payload providers, other space equipment and service providers and purchasers, and, if the company is profitable, public shareholders.

2. initial assets of the company would be all U.S. launch vehicles, including the shuttle fleet. This would allow the company to provide launch services tailored to customer needs. The company would finance the development of new launch vehicles from its proceeds, and might contract for the development of such a vehicle (or family of vehicles).

3. the government would be required to purchase its launch services from an outside supplier -- either from the company, from individual launch vehicle suppliers, or from overseas. This requirement would provide both the business base and create price competition for the company. Thus the company would not be a designated monopoly.

4. a 3-year transition pricing plan involving government subsidies would be developed to allow the company to operate profitably while prices increase (probably) from artificially low shuttle levels.

To create such a company, "a comprehensive legislation solution" would be required. Insurance availability would have to be assured, probably by government, and anti-trust considerations assessed. A first step would be creating an initial "business plan" to determine both commercial and political feasibility; if prospects appear favorable, a more detailed business plan would have to be developed.

Many, perhaps most, of the workshop participants found much of this proposal attractive and of interest, and would support it "if it could be put in place tomorrow." They also believed, however, that it was probably too comprehensive and would require too much legislation to be an appropriate response to the current situation. One major concern was whether the Department of Defense would be willing to participate in such an enterprise. Many were skeptical; one participant noted that DOD does procure other essential services from private suppliers, was interested in more efficient and lower cost access to space, and was supportive of overall U.S. superiority in access to space. Thus if this approach might provide such superiority, DOD could well support it. Some speculated that a modified version of such a company might be viable even if DOD did not participate.

There were some arguments in support of even the short-term relevance of this approach, if the major changes in policy required could be accomplished. Since existing U.S. launch vehicles are in fact the technical basis for such an undertaking, the company could "spread the business" across all or most ELV suppliers, thereby assuring their viability. (It was pointed out by some participants that this would make almost impossible the entry of new firms into the launch services business.) Continuity and economies of scale were other likely benefits of an aggregated launch supply organization -- a "single shopping place."

Another issue raised, however, was whether this would in effect create a de facto monopoly of launch supply, thereby creating a need for government price regulation. In this situation, the only source of competition to the national company would be foreign launch suppliers. Healthy competition among all suppliers, some suggested, was preferable to a single U.S. launch supplier. One response was that it was in the national interest to work toward a single family of low cost, high reliability launch vehicles.

B. Availability of Launch Insurance

Two different perspectives on how to make available insurance coverage for commercial satellite launches were presented to the workshop. A position paper submitted by Ford Aerospace Satellite Services (Attachment J) suggested that "the inability to secure adequate insurance at historically based rates has a particularly deleterious effect on U.S. communication satellite owners/operators and, in turn, on U.S. communications satellite manufacturers. . . . Commercial satellite operators now face $300 to $500 million investment decisions without any assurance that coverage will be available at the time of launch, and with no certainty of insurance premium rates."

One suggestion of how to address this problem was for the U.S. government to create an entity to provide commercial launch insurance; properly designed, such an approach would not require the expenditure of public funds. Premium rates would be based on a constantly revised historical loss rate (not on the losses in recent years) plus administrative and loss pool premiums. Details of this proposal are given in Attachment J. It was pointed out by some participants that there seemed to be little enthusiasm within government for such a federal insurance initiative.

The other option presented was the creation of a privately organized American Space Insurance Underwriters group that would pool launch insurance coverage tailored to the needs of those who plan to operate in space. This approach also would not require the expenditure of public funds; the government role would be limited to creating a policy climate congenial to such collective private activity. There is a precedent in the American Nuclear Insurers group. Such a pool would be adequate to provide the advanced assurances of insurance availability and rates that are required. This approach could also provide insurance flexibility if it were necessary to switch a payload from one launch vehicle to another. The insurance industry, it was argued, is eager to participate in the space enterprise, if an environment that makes it possible is created. One step would be for the government to designate a chosen instrument for providing insurance -- "a public utility" approach.

No clear preference for one of these alternatives emerged in the workshop discussions, but participants did agree that insurance at an acceptable price was becoming a very scarce resource and that lack of insurance was likely to be a "show stopper" regarding commercialization of launch vehicles. It was also pointed out that adequate liability insurance for launch vehicle operations was an important element of successful commercialization.

C. Reliability of Launch Systems

The question of insurability of space activities is intimately associated with the reliability of all phases of space operations, but particularly of the launch phase. A number of workshop participants sensed that there was a systemic problem with the reliability of current launch systems, and thus were receptive to the proposal advanced by one participant that there be a national review function to assure launcher reliability, and particularly the reliability of propulsion systems.

The argument in support of this position was that such a function should not be carried out by launcher manufacturers themselves, which have a vested interest in proclaiming their systems reliable. A single government review office (not part of NASA) would create a base of knowledgable individuals available to conduct an independent review for satellite owners, operators, and insurers. Individual firms don't have the talent to do this on their own. These reviewers should be involved on a continuous basis, not just at a final launch review. Models include the kind of function the Federal Aviation Administration plays with respect to certifying flightworthiness and maintenance of passenger aircraft or what the American Bureau of Shipping does for the U.S. merchant marine fleet. It is of fundamental importance that the United States do something to improve the reliability of its launch systems.

This recommendation was strongly supported by one of the participants from the insurance industry. He pointed out (as did the Rogers Commission) that internal NASA quality assurance and reliability efforts had not been adequate, but disagreed with the Commission's solution of a higher level NASA review board, which will have a fundamental conflict of interest with respect to NASA launches. It is now not clear to whom insurers and owners/operators can turn for safety and reliability assurances, yet such assurances are critical to lowering insurance rates, which currently reflect an inability to determine reliability rates. In the case of DOD Titan launches, it was pointed out, the Aerospace Corporation does perform an independent review of the readiness to launch. Another ELV manufacturer pointed out that such an independent review was part of its commercial plans.

However, there was some objection, particularly from the ELV manufacturers, to the notion of a new, independent review board. Manufacturers have strong incentives toward reliability. They find failure investigations extremely painful, and they are more familiar with their launch systems than any outsiders. They pointed out that there are already multiple reviews in the process leading to the launch decision. Also, Department of Transportation regulations require reliability assurances, but there are problems in combining promotional and regulatory requirements in the same organization.

Others agreed that this sort of function would be useful in the earlier stages of preparing a launch vehicle and spacecraft for launch, but not at the later times of reviewing launch readiness or of the decision to launch. At that point, the incentives to succeed rest strongly upon the launch vehicle supplier, and another group with a go/no-go power is not required.

IV. Conclusion

Hopefully this report has summarized the most pressing and significant topics discussed at the workshop and has accurately suggested the wide range of views and opinions put forth by the participants. The report cannot possibly communicate either the totality of perspectives or the intensity and frankness with which all participated. It was truly a learning experience for all involved.

In closing, it is worth pointing out a fundamental problem with nascent commercial space industries, including those based on providing launch services. That problem is the sensitivity of commercial prospects in space to government policy decisions, at a time when those decisions have not yet settled into a stable pattern. The result is a high level of uncertainty in any business calculations with respect to space activities.

A cautionary tale in this regard can be drawn from the workshop contributions from various upper stage manufacturers. Those firms based their business decisions on a government policy that since 1972 had been articulated by four administrations and supported by seven Congresses and that said that the shuttle was the primary U.S. launch vehicle. Now that this policy is being revised, their chances of business success may be significantly diminished. As one participant suggested, elements of industry that were formerly accomplices of government policy may now be its victims.

This is a perspective worth considering as a new government-industry partnership in providing a viable U.S. ELV capability is developed. Yet the national need for such a capability is so great that some action is clearly required. AIAA hopes that this workshop was a useful contribution in shaping that action, and thanks the Committee on Science and Technology for the opportunity to become involved.

ATTACHMENT A

U.S. HOUSE OF REPRESENTATIVES
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May 20, 1986

John Clark, Vice President
Public Policy
AIAA
1010 16th Street, NW
Washington, DC 20036

Dear Mr. Clark:

In the aftermath of the Challenger accident, there seems to be broad agreement on two points regarding expendable launch vehicles: (1) the need for a well functioning ELV capability in order to have a robust space launch system; and (2) the desirability of the private sector engaging in the development and operation of this ELV capability.

Discussions on these questions are active throughout the aerospace community. Our purpose in writing you is to request your assistance in bringing together the concerned private parties who would be affected by ELV commercialization to discuss the feasibility of developing a truly viable, commercial, and competitive United States ELV industry. I would hope that such an AIAA forum would bring together ELV manufacturers, commercial satellite manufacturers and owners/operators, other users of launch services (such as scientists), upper stage manufacturers, representatives from the financial and insurance communities, as well as other appropriate representatives from the space community.

We would like for such a workshop to occur within the next 6 to 8 weeks. We would also request that you produce a report to us on the workshop, which would objectively assess the likely success of a commercial ELV industry in the United States and the advantages and disadvantages of the various initiatives that have been proposed to promote the startup of the ELV industry. Moreover, if a viable commercial ELV industry does not seem to be a realistic possibility, what other way can the United States be assured access to space?

I have asked the staff of the Subcommittee on Space Science and Applications to consult with you and otherwise assist you as plans for the workshop proceed. Final details of the workshop, such as participation, scope and format, would be subject to my concurrence.

I look forward to AIAA's participation in and organization of this important policy workshop.

Sincerely,

DON FUQUA
Chairman

ATTACHMENT B

AGENDA

Expendable Launch Vehicle Workshop

Organized by
AIAA Public Policy Committee
for
Committee on Science and Technology,
House of Representatives

Airlie House, June 25-27, 1986

Wednesday, June 25

2:00 p.m. - 6:00 p.m.	Check in at Airlie House
5:30 p.m. - 6:30 p.m.	Cash Bar
6:30 p.m. - 7:30 p.m.	Dinner
7:30 p.m. - 10:00 p.m.	Executive Branch Briefing

Participants

Madeline Johnson, Office of Commercial Space Transportation, Department of Transportation

Gerald May, National Security Council

Courtney Stadd, Department of Commerce

Jerry Fitts, Office of Customer Services, NASA

Thursday, June 26

9:00 a.m. - 12:15 p.m.	Space Transportation: Supply and Demand

Potential Discussion Topics:

- Reactions to Executive Branch briefing
- Likely future relationship between the shuttle and ELVs
- Availability of U.S. ELVs
- Factors affecting the cost of space transportation services
- Character of foreign competition in supplying launch services

- Demand projections: How many communication satellites?
  What other payloads?

- Requirements for launching scientific and research payloads

- Prospects for upgraded/modernized ELVs

- Prospects for upper stage suppliers

12:15 p.m. - 1:30 p.m. Lunch

1:30 p.m. - 5:00 p.m. Creating a Viable U.S. ELV Capability

Potential Discussion Topics

- Availability of adequate financing

- Availability of adequate insurance

- Availability of adequate infrastructure and facilities

- Requirements from the ELV manufacturers' viewpoint

- Requirements from the upper stage manufacturers' viewpoint

- Requirements from the users' viewpoint: satellite manufacturers, satellite users, the scientific community

- Factors determining U.S. competitiveness in the global competition for launch contracts

6:30 p.m. - 8:00 p.m. Steak Cookout (Weather Permitting)

8:00 p.m. - 10:00 p.m. Initial Identification of Federal Policy Options Regarding a Viable ELV Capability

Friday, June 27

9:00 a.m. - 12:30 p.m. Assessing Options for Federal Action

Potential Discussion Topics

- NASA and ELVs

- DOD and ELVs

- DOT and ELVs
- Are government guarantees required?
- Are other forms of subsidies needed?
- What other policies would help?
- Have options been missed?
- Potential for international collaboration?

12:30 p.m. - 1:30 p.m. Lunch -- Workshop Ends

ATTACHMENT C

LIST OF PARTICIPANTS AND OBSERVERS FOR AIAA WORKSHOP
June 25-27, 1986

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ATTACHMENT D

RCA AMERICOM
RECOMMENDATIONS FOR LAUNCH SERVICES

RCA American Communications, Inc., (RCA Americom) a wholly-owned subsidiary of RCA Corporation, is a pioneer in the satellite communications field, having been in this business since 1973. RCA Americom launched its first C-band satellite in 1975 using a Delta expendable launch vehicle (ELV); and, of the subsequent nine satellites, seven Satcom C-band satellites have used the Delta launcher, and two Ku-band satellites have used the Shuttle.

Recent events have created new interest on the part of the U.S. Government in a mixed fleet of Shuttles and ELVs. RCA Americom strongly recommends prompt expansion of NASA launch services to include a Shuttle/ELV mixed fleet. Under no circumstances should commercial space ventures be denied access to Shuttle launch services. The mixed fleet concept requires adequate Shuttle availability as well as an adequate mix of expendable launchers to enable it to meet future launch requirements.

- Returning to a single U.S. launch system is unacceptable to the commercial users of space, be it the Shuttle or a single expendable system. Events of the last several months have shown the vulnerability of the U.S. to an extended shutdown.

- Specifically, RCA Americom recommends immediate expansion on the part of NASA to a mixed launch fleet using both the Shuttle as well as expendable launch vehicles. The fleet should be made up of vehicles with sufficient flexibility to be capable of launching, at economical rates, satellites across a wide range of payload weights. Flexibility can be provided by a mixed set of vehicles in addition to the Shuttle, including the Delta, Atlas Centaur and Titan, in various configurations. In the interest of reducing launch costs, there should be a multiple payload capacity for ELV launches, similar to the Shuttle.

- RCA Americom does not believe it prudent to attempt to foster ELV commercialization by excluding commercial satellites from the Shuttle. We also do not believe that commercialization of U.S. launch services without extensive government assistance, at least initially, will offer a competitive alternative to foreign ELVs, such as Ariane.

- RCA Americom believes that ELVs can be competitive with foreign launch services and offer a parity with Shuttle pricing, but only with U.S. government support. Such support is justifiable, since the U.S. government should place a value on the prestige associated with having a highly-reliable but still price-competitive mixed fleet. It also addresses the outflow of millions of dollars to foreign launch services.

- Government assistance could take various forms. For example, a commitment by the government to use ELV launch services for military and space exploration packages would increase production, thereby reducing the cost per launch. The government should accept responsibility for providing ELV launch capability as a national resource and develop a reimbursement policy based on recovery of incremental costs applicable to both ELVs and the Shuttle.

- Given the present situation, we do not believe ELV commercialization should begin until the present U.S. launch crisis is over and the backlog of commercial and military space packages has been substantially reduced, if not eliminated altogether.

- Once the problem of the current backlog has been dealt with, if the government continues to favor transition of ELVs with appropriate government support to private industry, NASA should be the exclusive government agency to guide the transition, and then only to qualified launch vehicle manufacturers. With its ELV background and expertise, which will be enhanced with immediate expansion of the NASA fleet to include state-of-the-art ELVs, NASA is more capable than other agencies, which lack its hard-earned knowledge, experience and technical management skill. Even after the transition has been underway, NASA should remain the government's cognizant agency to insure that a cost-competitive U.S. ELV launch capability is maintained. Using its demonstrated expertise in this area, NASA could promote performance and reliability improvements, monitor the design of hardware manufacturing, and assure the reliability of an adequate volume of launch services at the least possible cost. To interpose other U.S. government agencies or private entities as middlemen or agents between launch vehicle companies and satellite operators would not be productive.

RCA Americom believes the foregoing recommendations are necessary to maintain the competitive edge that the American satellite manufacturers and owners-operators now hold in the world. As one of the largest owner-operators of domestic communications satellites, RCA Americom projects system expansion as well as replacement needs. We will shortly have a need to launch a ground-spare satellite, which is not Shuttle compatible and therefore must be launched by an ELV. As part of our system expansion, we intend to place additional Ku-band satellites into orbit. In addition, our existing fleet of C-band satellites will be reaching the end of their usable lives in the 1991 to 1995 timeframe. We therefore believe that NASA should make greater use of ELVs and make those vehicles as well as the Shuttle available to the commercial sector without further delay.

ATTACHMENT E

Ford Aerospace
Satellite Services Corporation

PROPOSED U.S. GOVERNMENT LAUNCH VEHICLE POLICY

o RE-ESTABLISH AS SOON AS POSSIBLE AND SUSTAIN A DOMESTIC EXPENDABLE LAUNCH VEHICLE CAPABILITY TO ASSURE AVAILABILITY OF U.S. LAUNCH SERVICES FOR GOVERNMENT, COMMERCIAL AND FOREIGN PAYLOADS.

  - RESTART PRODUCTION OF EXISTING ELV'S BASED ON LAUNCH OF GOVERNMENT PAYLOADS NOT REQUIRING USE OF THE SHUTTLE.
  - MODIFY EXISTING U.S. ELV'S TO COMPETE IN MASS, SIZE AND PRICE WITH ARIANE IV UPPER AND LOWER SPELDA POSITIONS (2845 KG AND 2000 KG TO GTO FROM ETR RESPECTIVELY).
  - DEVELOP A NEW FAMILY OF ELV'S TO COMPLEMENT AND BACK UP THE SHUTTLE AND TO COMPETE WITH FOREIGN LAUNCH PROGRAMS.
  - PROVIDE U.S. LAUNCH SERVICES THROUGH NASA OR A COMMERCIAL MARKETING ENTITY ASSOCIATED WITH NASA.

o MEET EXISTING OBLIGATIONS TO COMMERCIAL AND FOREIGN USERS FOR USE OF THE SHUTTLE DURING THE TRANSITION FROM THE PRESENT SHUTTLE-ONLY POLICY.

FORD AEROSPACE & COMMUNICATIONS CORPORATION
JUNE 20, 1986

Ford Aerospace Satellite Services Corporation

PROPOSED U.S. GOVERNMENT LAUNCH VEHICLE POLICY

- PRICE SHUTTLE AND U.S. ELV LAUNCHES FOR COMMERCIAL AND FOREIGN CUSTOMERS TO RECOVER FULL COSTS LESS DEVELOPMENT.
- ASSURE AVAILABILITY OF LAUNCH INSURANCE BY ESTABLISHING A FEDERALLY CHARTERED INSURANCE CORPORATION.

FORD AEROSPACE & COMMUNICATIONS CORPORATION
JUNE 20, 1986

1581A

ATTACHMENT F

POSITION STATEMENT OF MCI TELECOMMUNICATIONS CORPORATION REGARDING FUTURE COMMERCIAL EXPENDABLE LAUNCH VEHICLES

Prepared By: Michael T. Lyons, Vice President, Space Resources

I. INTRODUCTION AND OVERVIEW

On behalf of MCI/SBS, I would like to express my gratitude for this opportunity to present our views regarding future U.S. launch plans and policy. The recent tragic events, which have virtually halted the planned launches of commercial satellites by the U.S., has clouded the future of MCI's satellite telecommunications program at a very critical juncture in time. Satellite communication systems in geostationary orbit have unique properties and features which allow access and direct linkage over very large areas. However, they have limited life cycles which require replenishment on a periodic basis. This makes the availability of launch systems at predictable and competitive cost an essential element in the commercial viability of satellite communication systems. By having relied on the Space Shuttle (STS) for inserting commercial payloads into orbit, we are now faced with long delays and uncertainties about our future plans for meeting business objectives and providing reliable services to our customers. MCI has an imbedded space related investment in excess of one billion dollars, and to allow the ground portion of that investment to be idled due to the lack of an available satellite would represent a major financial hardship for MCI.

MCI is not alone, the U.S. domestic satellite industry has an investment of several billions of dollars in spacecraft, earth stations, operating facilities and related communication network hardware and software. New applications are emerging in which thousands of small earth stations, located on customer premises, will be used in a variety of telecommunication modes and services which may revolutionize the industry. We have been very dependent upon U.S. technology and U.S. programs for the development of this industry, and for maintaining a substantial competitive lead in the international arena. This has provided significant benefits to the U.S. in terms of international trade and services that have supplemented domestic benefits. The present uncertainty regarding launch system availability and related costs have created serious concerns about the future.

It would appear that limiting the satellite communications industry to only one U.S. launch system, as has been the practice during the last few years, was an error. The same can be said for many government and scientific satellite systems which have relied on the STS for launch services. All of these would have benefited with the existence of an alternative launch system. Thus, we strongly endorse the creation of a U.S. expendable launch vehicle capability to complement the STS. The basic design and manufacture of expendable launch vehicles was pioneered, and popularized by the U.S., and there are no technical obstacles to the implementation of an expendable launch vehicle capability.

We wish to stress that to provide the necessary availability of

U.S. launch services for commercial programs, as well as DOD and scientific payloads, both the STS and expendable launch systems are required. Simply switching future launch services to only an expendable system would not meet the necessary availability criteria. In most instances, the communications satellite users would prefer to rely on expendable launch vehicles, however, the availability of the STS to back up the expendable fleet and to smooth periods of peak launch activity is essential.

It is quite evident that the timely development of a viable expendable launch capability for the above applications can only come about with some form of U.S. government support and management. We recognize that the transition to a versatile launch vehicle fleet, that includes expendables as well as STS's, requires careful planning and management to avoid major revisions and modifications to existing satellite communications carrier's programs which could result in severe financial penalties. We are prepared to help in this process in every way that is feasible.

II. EXPENDABLE LAUNCH VEHICLE REQUIREMENTS

As a user of launch vehicles, MCI has formulated a series of requirements which we believe are essential for a commercial expendable launch vehicle for the domestic satellite communications industry. The price of the launch vehicle must be competitive with that of the foreign alternatives, otherwise there will be no viability to the commercial offering. Moreover, the production levels and launch levels of the vehicle should be such that the user can obtain a launch in a timely fashion, meeting his specific needs. Typically a domestic satellite user can target his requirement date for the new satellite to within 6 months.

As we look at the launch vehicle requirements now and in the future, there are really two distinct classes of domestic communication satellite payloads. These payload classes are characterized normally by weight and dimensional factors. The lower weight class satellite payloads is in the 3,000 to 3,500 lb. class for geosynchronous transfer orbit. The heavier weight class, for the 3rd generation domestic communication satellites, are in the 5,000 to 6,500 lb. class, and have critical dimensions in excess of 10 ft., thereby requiring unusually wide launch vehicle fairings to accommodate the payload. Ideally, both ranges of payload weight and dimension could be accommodated on the same baseline vehicle (just as Ariane III and Ariane IV span these range requirements in the French system), so that the maximum economies of scale can be obtained in the production of engines, tankage, avionics and other flight components of the launch vehicles. It also provides economies in the use of the operational launch team.

Whichever suppliers are selected for the launch vehicles required for commercial programs, they should be corporations who are totally committed in terms of their baseline business to providing aerospace equipment and space related services. MCI fears a situation in which a supplier of the launch vehicle service is exclusively in the market because of short term financial interests and would default on his obligations in the face of a series of successive technical or financial setbacks. A single launch vehicle failure can result in the shutdown of an expendable launch vehicle program for up to a year, and can entail corrective design and manufacturing expenditures totalling in the tens of millions of dollars. As a consequence, the supplier of the service for commercial purposes must have a large financial resource and the commitment to stay in the business in spite of temporary setbacks. MCI endorses selection of one of the existing launch vehicle suppliers with the established record of reliability of their engines, avionics, and structural hardware.

MCI feels it is extremely important to maintain a reasonably high annual launch rate, not only for the purposes of minimizing the launch costs, but also in order to maintain an active, alert, highly competent launch team to assure high quality of operational launch services. For this reason it seems highly desirable to concentrate the commercial expendable launch vehicles into a single family or a maximum of two families of vehicles in order to maintain the highest feasible launch rate.

Finally, it is necessary for the commercial launch vehicle to be insurable. At the present time insurance costs are near prohibitive and there is a reasonable prospect of no insurance being available at all in the future. It is conceivable that the government will need to play a role, in at least the early start-up phases of the commercial expendable launch effort in order to stimulate confidence in the launch vehicles.

III. RECOMMENDED U.S. GOVERNMENT ROLE IN SUPPORT OF EXPENDABLE LAUNCH VEHICLES

There are a substantial number of economic hurdles which must be met by any launch vehicle manufacturer if he is to become a commercially viable supplier of launch services. He will have to accomplish the development necessary to upgrade his vehicle; he must develop confidence that the production levels will be high enough to assure him of a competitive set of costs for both the manufacturing and operations phases; he must devise a mechanism for demonstrating to potential users of the vehicle that it is reliable; and finally, he must show that its capable of being insured either in the marketplace or by means of a protective pool of funds.

As was indicated previously, the expendable launch vehicle family that previously existed in the United States, was consciously phased out as a result of a series of government policy decisions. Independent of whether those decisions were right or wrong at the time, the reality is that there are no longer production capabilities for these launch vehicles in existence, and a substantial amount of early investment in tooling long lead hardware, and other production elements will be necessary for any company to once again begin to manufacture the expendable launch vehicles. Moreover in the intervening time since the expendable fleet ceased production, there has been an ongoing and evolving series of requirements related to communication satellite payloads which are beyond the capabilities of these vehicles. As a consequence, it is no longer practical to restore these vehicles to production in their prior form and expect to be competitive in today's market. The dimensions of the satellites and their weights have grown since the demise of the U.S. expendable launch vehicle fleet, and a reasonable amount of development effort is necessary to upgrade those vehicles, if they were to be selected, to meet the current and future needs of the domestic communication satellite community.

With these objectives in mind, we feel that in order for the U.S. to produce a commercially viable expendable launch vehicle or vehicles, it will be necessary for the U.S. government to sponsor the development necessary to bring the launch vehicles to a competitive stature. The government must also serve as user of the vehicle and thereby guarantee to the commercial entities a certain assured launch rate for a series of years. The government should also provide the quality assurance for the vehicle and particularly for each and every new evolutionary development of the vehicles. And finally, from the standpoint of assuring stability of launch operations, it is highly desirable that the government provide the launch operation, and that the individual launch service customer pay his incremental share of the expended manpower and facilities based on his actual usage.

With the exception of the requirement for the government to procure a series of vehicles for their own use, all the other recommendations contained herein are features of the existing Ariane commercial launch vehicle effort, with the French government providing the research and development, quality assurance and launch operations.

IV. SUMMARY

This paper briefly summarizes MCI's position with respect to a commercial expendable launch vehicle industry. We feel that the views of MCI are representative of the satellite common carrier industry, and that these views should be provided serious consideration by the Commercial Space Working Group of The Economic Policy Council. We appreciate the opportunity to provide our opinions and we are also encouraged by the accelerated manner in which the Commercial Space Working Group has adopted hearings on this subject. The satellite communications industry recognizes that a solution to the commercial expendable launch vehicle is four to five years away and does not provide a near-term solution for meeting our business objectives. However, we feel that it is mandatory that the U.S. government move expeditiously to adopt an accelerated program to define and stimulate the development of the commercial expendable launch vehicle program.

ATTACHMENT G

HUGHES
Subsidiary of GM Hughes Electronics

POSITION PAPER

U.S. LAUNCH VEHICLE POLICY

For fifteen years and under three Administrations, private satellite users have been forced to move from alternative launchers to the Space Shuttle. As a result, satellite builders like RCA and Hughes have invested well over $100 million to design and qualify new families of spacecraft that would use the Shuttle most efficiently. The old Atlas, Delta, and Titan launchers are now either too small, too expensive or not powerful enough to launch such satellites. NASA progressively raised the prices of the alternative Atlas and Delta vehicles and ultimately terminated their production. Therefore, the European Ariane is currently the only viable alternative to the Shuttle.

Reliance on a single launch vehicle in the United States has been a policy of tragedy. Realizing this, the U.S. Air Force two years ago ordered ten large Complementary Expendable Launch Vehicles (CELV's), derived from the Titan, to provide backup capability. The Challenger crash validated the need for such alternatives.

As a consequence of bad policies and bad luck, the U.S. must now deal promptly with a serious short-term problem: A real shortage of launch capacity. We must also address the long-term problem: The need for a reliable, cost-effective, and complementary fleet of launch vehicles. —

The Short Term

There will be shortage of launch capacity until the end of the decade. The stand-down of the Shuttle fleet, the time needed for re-design, the reduction of the fleet from four to three, and the necessary launch rate reduction have already caused a backlog of satellites. In the short-run only a few measures are available to mitigate the shortage:

1) Commercial users whose satellites are compatible with Ariane can shift to that vehicle; some already have.
2) The priority of national security launches should be reviewed to insure that scarce launch resources are used efficiently.
3) Activation of the Vandenburg Air Force Base Shuttle facility should be deferred indefinitely. It is possible to launch all Vandenburg payloads with CELV's or by Shuttle from Florida. It is unwise to dedicate one-third of the Shuttle fleet to Vandenburg operations, and will cost an enormous sum each year to maintain such a capability.

The Long Run

There are important jobs to be done in space - military, scientific, and commercial. Those jobs require reliable and economical launchers. A desirable fleet would include both the Shuttle and unmanned rockets compatible with Shuttle payloads, so that they can back each other up. When the problems revealed by the Challenger disaster are dealt with, the Shuttle likely will be much more reliable than current ELV's. Certainly, developing a new generation of highly reliable launchers that can deliver payloads to orbit at a competitive cost will require major investments in new technology.

Arianespace leads the way to a low-cost Shuttle-compatible launcher with Ariane V, now under development. This investment in new technology is being made for Arianespace by the European Space Agency. No such project is underway in the U.S. Although partially compatible with the Shuttle, the Air Force CELV appears to be too large and too expensive to be commercially useful. Modifications to Delta, Atlas and Titan may be sufficient to make them compatible physically with satellites that will be built in the future. However, such modifications are likely to cost $50 to $100 million for each launcher, and will not produce economically competitive alternatives. Developing and testing a U.S. launcher that could becompetitive and that would achieve the needed reliability will cost hundreds of millions of dollars. It will certainly take more than five years to become operational.

Current Proposals

In the wake of the Challenger tragedy, some in the Government are advocating a complete reversal of the "Shuttle-only" policy. They propose now to deny completely the use of the Shuttle to commercial customers. Their proposal apparently rests on two premises:

1) That intelligence and military needs will consume all of the capacity of the Shuttle fleet.

2) That prospective U.S. commercial ELV manufacturers will not enter the business if the Shuttle remains a potential competitor.

The first premise is surprising. Military payloads had been expected to take about one-third of the shuttle's capacity. The reduction in near-term launch capacity certainly is causing a backlog problem. However, the Defense Department has bought CELV's, plans to buy more, and hopes to procure smaller rockets as well. Furthermore, budget constraints will limit hoped-for military, SDI, and NASA projects. If the government claims the entire fleet capacity, it is likely that it will have more launch capacity than it needs in the early 1990's. Of course, a decision to build a replacement for Challenger - which we support - would increase the capacity available beyond 1990.

The second premise has been promoted by the companies which are considering building ELV's on a commercial basis. Some in the government are supporting this thesis. Let us ask, would the end of foreign and commercial use of the Shuttle by itself be sufficient to bring into being a competitive U.S. ELV industry? Unless accompanied by a major infusion of government-sponsored development funding, it will simply produce a stillborn U.S. industry. It will be difficult for a companyto be commercially successful for the following reasons:

1) Arianespace is an entrenched, efficient competitor that has good technology, commercial skills honed during years of competition with NASA, and technical support from a consortium of eleven European governments;
2) Because of the years of U.S. neglect, major investments in ELV development will be required to produce vehicles competitive with the Ariane family. ELV development requires that a firm be able to risk multi-million dollar failures;
3) Demand for commercial satellite launches is inherently unpredictable. It is driven by the uncertain pace of developments in satellite technology and by the willingness of companies to bear major risks in bringing new services and applications to the market;
4) In the background, there are potential competitors in the U.S.S.R., China, and Japan, all of which have existing ELV programs and have clearly indicated a desire to serve commercial markets.

How many companies will be willing to risk hundreds of millions of dollars to enter such a market, even if competition from the Shuttle is foreclosed? If a U.S. company does enter the business, its position as a competitor to the entrenched Arianespace will be precarious. Because of Arianespace's advantages and its relations with European governments, U.S. competitors will be the weaker parties. If a U.S. company does not enter the business, then excluding commercial users from the Shuttle will simply create a European monopoly in a business of substantial importance to the United States.

International Competition

Even if the United States turns its commercial launch business over to the private sector, the role of government policies in the launch programs of other countries will predominate. At every turn, the U.S. firms will face competitors backed by their governments with the political, economic, and technical resources of those governments. If the business of commercial space launches comes to be dominated by other countries, the consequences for the United States will be serious:

1) The U.S. will forego its position in an industry that otherwise faces a promising future. Re-establishing a position later will be difficult, if not impossible.
2) The U.S. satellite industry is now a successful foreign trade competitor but will come under pressure to share design data required by foreign launching organizations for interface design and insurance decisions.
3) Foreign satellite manufacturers will be able to offer tie-in sales of launches and satellites as package deals (as U.S. firms now do), enabling heretofore uncompetitive satellite manufacturers to challenge the U.S. position.

Recommendations

Satellite owners and operators are part of the fundamental infrastructure which provides the links tying together much of the world. The importance of their role requires them to accept responsibility to provide reliable and continuous service. To discharge that responsibility, they must be able to launch satellites when needed. The proposals currently before the U.S. Government threaten their ability to meet those responsibilities to the country and the rest of the world. Therefore, we recommend that:

1) Government users should be realistic in exercising their claim to first priority in the near term period when launch needs will exceed supply;
2) The government should continue its previous policy on Shuttle usage, rightly giving priority to defense and scientific uses, but fulfilling its commercial commitments and serving all users to the best of its ability;

3) The government should move quickly to begin construction of an orbiter to replace Challenger;

4) The government should move rapidly to develop a mixed fleet of cost-effective, compatible ELVs to complement the Shuttle. This will require a major investment in new technology and substantial coordination between the Defense Department, civilian agencies, and commercial users.

Need interim Solution

Super G

# # # #

June 5, 1986

ATTACHMENT H

A PROPOSAL TO ESTABLISH A NATIONAL LAUNCH SERVICE COMPANY

Jerome Simonoff
Vice President
Citicorp Industrial Credit, Inc.

Ingrained U.S. Launch Problems

The recent American launch failures have made the public aware of a series of problems that have been endemic for some time -- the inability of the United States to efficiently concentrate its resources to take the uncertainty out of transportation. Even before the Challenger tragedy, it was becoming virtually impossible to provide competitive service at a profit in an increasingly competitive world. We have viewed technological innovation as solutions to launch problems. The result was that the U.S. government went into competition with American industry as well as with Arianespace. With the multi-government resources available to Arianespace, it was able to compete with aggressive NASA shuttle pricing. The result was that American companies were not able to undertake a commercial launch business.

This policy could have been justified on the basis of greater economies offered to users from heavily used shuttle traffic. However, the cost to the industry was a loss in investment potential: For example, General Dynamics had announced that it was willing to undertake investing in potential thinly capitalized users of the Atlas vehicles. However, low shuttle pricing had precluded the company from going forward and, with the decision, the investment capital. Similarly, other companies, with substantial transportation experience were also discouraged from entering into a viable business. The result of the pricing posture was the driving of business to Ariane, which was prepared to match the prices, and had geographic advantages which made the service uniquely attractive to communication satellite users.

At present, Arianespace has been developing a "seamless" launch capability: the ability to offer a family of vehicles with performance that could be tailored to any payload. Also, not only does the company offer fine, high quality service, it is expanding its range of services to include insurance support in addition to export financial support that it already provides.

In the United States, however there seems to be agreement only on the fact that we have a competitive problem. There seems to be no solution that could be satisfactory to equipment suppliers, government agencies, or commercial launch service users. The key areas of disagreement involve the price of transportation and forced allocation of usage. Should comsats be allowed on the shuttle? Should the military developer purchase more ELV's? Should there be support from the government on obtaining insurance? Should there even be a replacement shuttle? The interests of the advocates, be they commercial suppliers or government agencies, are so far apart and diverse that problem of developing some forward momentum seems intractable.

A Potential Competitive Approach for the U.S.

Ideally, the best possible strategy for future transportation is agreement between all parties using the existing organizations. In the absence of a consensus, one solution to this problem is to borrow an idea from Arianespace, and form a national transportation company. Its charter would be to provide the government and commercial sectors transportation on a competitive basis. The organization would not have a designated monopoly status for providing transportation. However, the government would be precluded from providing its own service. It would have to purchase services from this organization or others such as Arianespace or independent American service suppliers.

Ownership Composition

Owners of the company would consist of today's launch vehicle suppliers, payload providers, other military and commercial space equipment and service suppliers and purchasers, and the U.S. Government (with major using and regulating agencies serving as supervising representatives). Payload suppliers and purchasers would be investors in order to allow them to participate in the profits from competitive and economically priced services. To the extent the company can demonstrate sustained profitability, shares could be sold to the public.

Initial Objective

The initial assets would consist of all present American launch vehicles ranging from the Delta or Conestoga to the CELV's and the shuttle. The organization would provide a "service" and, where possible, offer the services with backup vehicles of different types if one series encounters problems. The company would be able to provide a comprehensive range of services because most American launch vehicles tend optimally to be complementary rather than competitive. Their non-optimal capability overlap would enable the launch vehicles to back each other up in case of a launch failure from any one type. The company through its shareholders would be responsible for the development of new, advanced performance vehicles.

Long Term Objective

Once operating, the company may improve its cost structure. Through its investors, the company may undertake to develop a modular family of expendable launchers to develop production economies of scale. The company will also assume operating responsibility for future manned orbiters if built including the "aerospace plane". Development of manned vehicles or expendables will be at the descretion and funding of the individual shareholders unless the vehicles are directly relevant to the core transportation business of the company.

Critical Factors of Price and Profitability

The key to making the company profitable would be the assurance that the Department of Defense and NASA would purchase all of their launches from outside sources to assure a critical minimum volume. The key to making the price to the government competitive would be the freedom of the government to purchase services from companies outside the organization.

Attractive user prices would come from the ability of the company to amortize its investors' start-up costs over a large number of launches, the economies available from commercial operations and the development of a new low cost standard vehicles, if appropriate. To allow a profitable transition for commercial users, prices for the new company's launch services would be maintained at a level near today's shuttle prices. To enable this to occur while the company operates at a profitable level, the government would establish a fund that would pay the users the difference between the minimum price level necessary for the company to make a profit and today's shuttle level. This support would last for three years. For scientific users and JEA-type cargoes, the government would purchase the transportation service and supply, or resell the service to appropriate users.

Major Problems to be Overcome

Some of the basic problems that would have to be overcome would be creation of special legislation that would allow mixed government and commercial ownership. Also needed would be a legislative solution to allow competitive suppliers and users to operate collectively. Other problems are the traditions of the various government agencies of controlling their own launch vehicles. Similarly, the concept will not work without some predictable, reliable source of insurance. While sources of insurance could be pooled funding from the shareholders, this would be of limited value when compared to using the regular commercial markets with the U.S. Government providing a backstop assuring a reliable underwriting capacity.

Proposed Action Items

A two month task force should be assembled consisting of one commercial representative for each major of expendable system, one representative for the shuttle, and one representative of the upper stage manufacturers. These organizations will represent the interests of other potential investors. The activity would be funded by the participants. The task force would prepare a preliminary business plan including marketing, financial, organization, sizing requirements, and draft legislation to enable the company to operate.

Upon a determined favorable reaction of the Congress and the Administration, the group would be expanded to develop the comprehensive business plan with a detailed implementation staffing, organizational and capitalization requirements.

Funds expended by members of the group would be applied toward the value of the investment in the new company when formed.

ATTACHMENT I

PROPOSAL FOR A U.S. COMMERCIAL SATELLITE LAUNCH INSURANCE PROGRAM

Background

Inadequate availability of insurance for commercial satellite launches and excessive insurance premiums are jeopardizing the future of the U.S. commercial satellite industry. Efforts to reestablish a U.S. expendable launch vehicle capability for commercial satellites will be unsuccessful unless insurance issues also are resolved. The loss of eight insured communication satellites during the period 1983 - 1986 (coupled with the recent, highly publicized but uninsured losses of Challenger, two Titan rockets and one Delta rocket), has placed the commercial space industry into disarray. From 1977 to 1985, insurers paid claims of approximately $900 million compared to net premium receipts of $445 million resulting in a loss ratio of approximately 200%. During the 1983-85 period, the loss ratio was 330%. The insured loss of Ariane V18 on May 30, 1986, could result in complete withdrawal of insurance coverage for commercial launches.

The recent loss experience does not accurately reflect U.S. and foreign launch vehicle performance over the past 25 years, when U.S. ELV's were in regular production and launches were frequent. The exhibit shows the generally excellent experience of the four principle U.S. launch vehicles. The performance of the European Ariane launch vehicle series is also noted.

The recent losses have had two major impacts: premiums (including post check-out life insurance) have increased to levels which bear no relationship to historical loss experience; launch insurance capacity has declined dramatically, if it is now available at all. In 1983, launch premiums of 5 to 6% were paid; in late 1985 quoted premiums were in the 25-30% range. Prior to the May 30 Ariane launch, insurance capacity had declined from an estimated $125 million per launch to between $50 and $60 million, and premium rates, policy terms and coverage amounts were not available until 90 days prior to the scheduled launch date.

The inability to secure adequate insurance at historically based rates has a particularly deleterious effect on U.S. communication satellite owner/operators and, in turn, on U.S. satellite manufacturers. Commercial investment in space is characterized by a front loaded risk profile. Projects involve a long construction period (3-4 years) and high capital investment is required before space assets become revenue producing. In this unusually risky environment, commercial investors must have a reasonable assurance of profits and return on investment. History shows that they are willing to take market risks, but they cannot tolerate cost uncertainty (i.e. launch insurance premium rates) or inadequate or no insurance when the satellite reaches the launch pad. Commercial satellite operators now face $300 to $500 million investment decisions without any assurance that coverage will be available at the time of launch, and with no certainty of insurance premium rates. In the case of those projects funded with third party financing, loans would not be available in the absence of insurance or investor guarantees. Based on recent quotations, insurance, already the third largest cost component of a commercial satellite project, is approaching the cost of the launch services. Unless a solution is developed, the future supply of U.S. commercial satellites is jeopardized.

A decline of the U.S. commercial satellite business would have adverse effects on U.S. national interests. Not only will U.S. leadership in the peaceful use of space decline, but derivative technical and economic benefits to the United

States would be lost. Notwithstanding an action by the U.S. which would reestablish ELV capability, as other countries continue to develop launch capability supported by insurance programs, the launch vehicle business would emigrate from the United States. Eventually, the manufacture of commercial satellites and other space hardware would follow.

Recommendation

The U.S. Government is urged to consider creation of a commercial space insurance program as an integral part of the program to reestablish a U.S. expendable launch vehicle capability. In this conjunction, it is recommended that the U.S. Government create an entity to provide commercial launch insurance to stimulate and sustain the development of a U.S. expendable launch vehicle capability.

This is how such a program could work. The U.S. Government entity would make asset value based launch insurance coverage available upon signing an agreement to procure launch services from a U.S. supplier (3-4 years prior to launch). Premium rates would be based on the historical loss ratio for a particular launch vehicle plus an administrative premium (0.5% - 1.0%) and a reserve fee (2% - 3%) designed to form a loss reserve pool in the event future loss experience proves to be worse than historical loss ratios. The administrative premium would be designed to cover the cost of administration of the insurance program. Premium rates would be indexed to the overall historical loss ratios rather than recent experience but would be revised to include additional success or failure experience on a moving average basis.

The following is an example calculation of a launch insurance premium rate assuming a commercial payload launch today on an Atlas G/Centaur (historical loss ratio information is provided in the Exhibit):

	Launch Insurance Premium Rate (Through 120 Day Commissioning Period)
Historical Loss Ratio (Total Mission Sequence)	15.4%
Administrative Premium	0.5 (EST.)
Loss Reserve Pool Fee	2.0 (EST.)
Total Atlas G/Centaur Launch Insurance Premium Rate	17.9%

Launch insurance capacity would be defined to include the value of the following assets (prior to the declaration of the satellite as operational):

- Satellite
- Launch Services
- Mission Operations
- Apogee/Perigee Stages
- Launch Insurance Premiums
- Interest During Construction

The proposed program would be provided under the auspices of a Federally chartered corporation, initially capitalized by the U.S. Government which would convert at the expiration of a transitional period to a public stock corporation similar to COMSAT Corporation and the Federal National Mortgage Association. This program would not require subsidy of the commercial space insurance nor create a permanent government presence in the insurance business.

This proposal is intended to be a conceptual outline and many policy issues and details must still be addressed. These include:

- Allocation of insurance premium rates through each of the following launch and commissioning phases:
  - Low Earth Orbit (LEO)
  - Geostationary Transfer Orbit (GTO)
  - Geostationary Orbit
  - Completion of Satellite On Orbit Test and Check Out
- Evaluation of an alternative concept to fund the reserve pool through a portion of revenues earned by satellite owner/operators whose spacecraft are successfully launched.
- A schedule of rates related to deductibles to be assumed by satellite owners and hardware suppliers.
- Rates for all-new launch vehicles and stages.

Summary

It is proposed that the program to reestablish a U.S. ELV capability include the assured availability of adequate launch insurance capacity at rates based on historical experience for all commercial satellite missions. If launch insurance capacity continues to be inadequate and launch insurance premium rates remain at the present unjustifiably high levels, efforts to reestablish a U.S. ELV capability for commercial launches probably will be unsuccessful. The proposed insurance program would result in no cost and minimal risk to the U.S. Government, would protect the viability of the commercial space industry and would stimulate commercial use of U.S. expendable launch vehicles.

Prepared by:

Ford Aerospace Satellite Services Corporation,
a wholly owned subsidiary of
Ford Aerospace & Communications Corporation

For Further Information Contact:
Alan I. Parker
Chairman
(202) 785-4000

1532A

Exhibit

PROPOSAL FOR A U.S. COMMERCIAL SATELLITE LAUNCH INSURANCE PROGRAM
HISTORICAL SUCCESS AND LOSS RATIOS BY LAUNCH VEHICLE

Vehicle	First Launch	Number of Launches	Launch Vehicle Failures	Launch Vehicle Success Ratio	Other(1) Failures Through Commissioning Phase (First 120 Days)	Total Mission Sequence Success Ratio (Aggregate)	Total Mission Sequence Historical Loss Ratio (Aggregate)
GEO Transfer Orbit							
Delta	1960	179	12	93.3%	6	89.9%	10.1%
Atlas/CENTAUR	1962	65	9	86.2%	1	84.6%	15.4%
Subtotal GTO Launch Vehicles		244	21	91.4%	7	88.5%	11.5%
LEO Orbit							
Titan III & 34D	1966	134	5	96.3%	-	96.3%	3.7%
STS	1981	25	1	96.0%	4	80.0%	20.0%
Subtotal LEO Launch Vehicles		159	6	96.2%	4	93.7%	6.3%
Total U.S. Launch Vehicles		403	27	93.3%	11	90.6%	9.4%
Memo:							
Ariane	1979	18	4	77.8%	2	66.7%	33.3%

(1) Includes Apogee failures for GTO Launches and Apogee/Perigee failures for LEO Launches.

1528A

PAYLOAD PRIORITIES - APPENDIX #2

HUGHES
AIRCRAFT COMPANY

ALLEN E. PUCKETT Chairman of the Board and Chief Executive Officer

23 July 1986

Vice Admiral John M. Poindexter
National Security Council
Old Executive Office Building
Washington, DC 20506

Dear Admiral Poindexter:

We understand that serious proposals are being considered to exclude commercial communication satellites from future use on the Space Shuttle. Such a step would compound the tragedy of 28 January by killing the American communication satellite industry. This industry is totally financed by private capital, and represents sales of two billion dollars per year. It is one of the few high technology products that America is successfully exporting. Furthermore, we believe that exclusion of commercial satellites is unnecessary in order to provide for national security needs. Our reasons follow.

Ariane is the only viable launch alternative for the modern communication satellites now being developed by American companies. The Delta and Atlas Centaur rockets were programmed to be out of production now, and current satellite designs were based on the additional weight and volume of Shuttle and Ariane. Even if production of Delta and Atlas Centaur were revived, those rockets would not carry the spacecraft now in production for domestic and foreign customers. It is our considered judgement that entrepreneurial ventures cannot fill the shoes of Shuttle in the next decade.

If Ariane becomes the only practical alternative to the Space Shuttle, it is likely that Arianespace pricing policy will eventually force U. S. Satellite makers out of business. We have evidence already of a move in this direction when we negotiated recently for an Ariane launch to replace a scheduled Shuttle launch of a satellite we are building for Japan.

In any event, Ariane cannot service all of the considerable load that will be dumped on them if Shuttle is denied to commercial users. The consequence must be a preference for European space programs and satellite builders, and rapid decline in the only commercially successful U. S. venture which has flowed from our space program.

Corporate Offices: 7200 Hughes Terrace
P.O. Box 45066, Los Angeles, CA 90045-0066
(213) 568-6100

For two important reasons, we believe that it is now unnecessary to deny Shuttle use to commercial users. The first is the cancellation of the Centaur Upper Stage which had been planned to lift heavy satellites from low earth orbit to higher regions of space. The NASA planetary missions are thus removed.* The larger Shuttle/Centaur demand was for national security payloads. Milstar has planned to use this combination as did a considerable number of important spacecraft that Mr. Aldridge sponsors. Both the NASA and DoD payloads in this large family must now move to expendable launch vehicles.

The second reason is that the Air Force is planning to buy additional CELV rockets. The CELV's are too large for commercial satellites and, in any case, are too urgently needed to carry DoD payloads to be a factor. However, they should help mightily in off-loading near term Shuttle flights and relieve the long term backlog problem of military missions originally planned to fly on Shuttle.

Moreover, if we do not activate the Vandenburg Shuttle facility in the next few years, we can concentrate its three remaining Shuttle vehicles in Florida. This will give better utilization of the fleet.

The Air Force, through its Medium Launch Vehicle program, is willing to support the development of ELV's capable of launching the communication satellites now in production. We applaud this policy, and we believe that in the long term the MLV program will be successful. However, it will take many months to define the MLV program in detail. In the meantime, no American ELV manufacturer is prepared to negotiate definitive contracts for commercial satellite launches.

We propose that no final STS policy decision be made at this time. We suggest that NASA do its best to support the commercial satellite industry with the Shuttle until the Air force MLV and the ensuing commercial ELV programs are defined and stabilized.

Clearly the national security program should have first priority on Shuttle flights. However, we believe that the DoD needs for shuttle flights are decreasing rapidly. If this is correct, it would be tragic to preclude comercial users from Shuttle and so condemn the only American commercial success in space that is likely to emerge in our time. I would be happy to come immediately to Washington to discuss this with you or your colleagues if that will serve a useful purpose. Please call me at my office or Dr. Albert D. Wheelon at his office at 213/568-7504.

Sincerely,

Allen E. Puckett

ALLEN E. PUCKETT

/lb

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* Galileo, Ulysses, and Magellan

cc: The Honorable C. W. Weinberger
The Honorable M. Baldrige
The Honorable E. H. Dole
The Honorable E. C. Aldridge, Jr.
Dr. J. C. Fletcher

General Offices/3M

3M Center
St. Paul, Minnesota 55144-1000
612/733 1110

PAYLOAD PRIORITIES - APPENDIX #3

3M

August 4, 1986

HOUSE SUBCOMMITTEE ON SCIENCE & TECHNOLOGY
2321 Rayburn House Office Building
Washington, D.C. 20515

Attention: Lillian Trippett, Legislative Assistant

Gentlemen:

Recently, a letter regarding 3M's position on the U.S. Space Shuttle payload priority system was requested by the House Subcommittee on Science and Technology. As we are all aware, the priority of payloads at this time is: (1.) Department of Defense; (2.) Industrial customers; and, (3.) Foreign or International payloads.

In the wake of the Shuttle disaster, the U.S. now has the opportunity to reanalyze the payload priority system. 3M, as an industrial organization, for obvious reasons, is ultimately interested in product manufacturing. It is this goal that has led us to attempt to expand our knowledge base into the microgravity environment and seek a 10-year Joint Endeavor Agreement (JEA) with NASA. It is this JEA that we hope will provide us with opportunities for product manufacturing through the materials research knowledge gained in space.

An endless supply of possible uses of space manufacturing exist, including materials processing in space and the manufacture of drugs and chemicals. It is, therefore, imperative to take advantage of the unparalled economic expansion that could occur with the advent of space-based manufacturing. To accomplish this, a vehicle is required which provides, not only access to space, but a prompt return enabling the materials to be retrieved expeditiously and the results investigated. The U.S. Space Shuttle is the most appropriate vehicle to provide this accessibility.

We realize that the space effort is a national program and, therefore, respect and support the DOD's applications and use of the shuttle and its number one payload priority. However, in light of the recent decision to not immediately appropriate funds for the fourth orbiter, accessibility to space will be extremely limited, and it is this limitation that forces a determination as to which payloads are absolutely shuttle dependent. As these shuttle-dependent industrial payloads become more prevalent, using microgravity to obtain the next leading edge technology, it is of vital importance that they are afforded a high priority in the effort to maximize use of shuttle space.

We recognize that other payloads may exist that are shuttle dependent and that a balance and degree of flexibility must be exercised to accommodate the DOD and industrial organizations. It is our belief that, by expanding and maximizing the opportunities available in space processing and manufacturing, the quality of life can be improved for everyone.

Sincerely,

L. C. Krogh

Lester C. Krogh, Ph.D.
Vice President
Research & Development

LCK:jmb

PAYLOAD PRIORITIES - APPENDIX #4

COMSAT

**COMMUNICATIONS
SATELLITE
CORPORATION**

Marcel P. Jo[illegible]
[illegible]

July 22, 1986

Robert Brumley, Esq.
Deputy General Counsel
Department of Commerce
Room 5870
14th & Constitution Avenue, N.W.
Washington, D.C. 20232

Dear Mr. Brumley,

I am writing to you in your capacity as Chairman of the Commercial Space Working Group of the Economic Policy Council, in connection with deliberations now being conducted within the government concerning the assignment of commercial satellites to the STS launch manifest. Comsat Corporation and the two international satellite organizations in which we are the designated U.S. participant — INTELSAT and INMARSAT — have fundamental interests at stake in regard to the development of national launch policy and the composition of the Space Shuttle's launch manifest for the coming years.

As you may know, the INTELSAT system, which carries the preponderance of U.S. international communications, has been the single largest commercial user of Space Shuttle launches. And the INMARSAT system, which provides maritime communications to over 4500 ships and offshore oil platforms worldwide, has contracted with NASA for the launch of two of its second generation satellites. In considering the allocation of launch resources to these international organizations, it bears emphasis that established United States policy (based upon the Communications Satellite Act and the International Maritime Satellite Telecommunications Act) is to foster and support the INTELSAT and INMARSAT Systems. We believe that this policy, and the national interest which it aims to promote, merit heavy weight in the Working Group's considerations.

In this regard, Comsat has undertaken to prepare a White Paper which examines NASA's statutory responsibility under the Communications Satellite Act to launch INTELSAT satellites. This White Paper, which is presented herewith to the Working Group, concludes that NASA is subject to an affirmative duty to furnish "satellite launching and associated services required for the establishment, operation and maintenance" of the INTELSAT system. While NASA's responsibility to INTELSAT must be read as subordinate to national security launchings and as coordinate with launchings of civil government missions authorized by Congress, we believe that due regard for the provisions and policy of the Communications Satellite Act requires that the launch needs of INTELSAT should be accorded precedence over other commercial satellite systems.

950 L'Enfant Plaza, S[illegible]
Washington [illegible]
Telephone [illegible]
Telex [illegible]

Comsat also has in preparation a White Paper addressed to policy issues arising from INMARSAT's need for launch support. As you are aware, other nations are moving forcefully to exploit the current grounding of launch capabilities in the West. We believe that the most effective means of defusing foreign commercial launch initiatives that involve technology export and associated national security concerns would be for the U.S. to provide reassurance as to future Shuttle availability for INMARSAT satellite deployment. Our expanded views on this subject will be forwarded to the Working Group shortly.

With respect to the issue of national launch policy in general, all agree that the U.S. must find a way to reassert pre-eminence in space, which is one of our most precious resources. We believe that this objective can best be attained by the development of a versatile mixed fleet of satellite launchers, composed of shuttle orbiters and various types of ELVs, and providing reliable access to space at costs competitive with launch services offered by other countries. In our view, the government must play an active role in revitalizing this nation's launch vehicle industry; otherwise U.S. leadership in this crucial arena of international competition will be imperiled.

We hope that this contribution will prove helpful to the Working Group. We would also welcome the opportunity to meet with Working Group members on this important matter and to cooperate with the Working Group in any way we can.

May we ask if you would be so kind as to distribute copies of this White Paper to other members of the Working Group. For your convenience, ten copies are enclosed.

Sincerely,

Marcel P Joseph

Marcel P. Joseph

cc: Mr. Issac Gillam,
NASA,
Vice Chairman of Working Group

July 22, 1986

WHITE PAPER

Application of the Communications Satellite Act of 1962 to the Launching of INTELSAT Satellites by NASA

Communications Satellite Corporation ("COMSAT"), the designated U.S. participant in the International Telecommunications Satellite Organization ("INTELSAT") has undertaken to prepare a White Paper for submission to the Commercial Space Working Group of the Economic Policy Council. The purpose of the White Paper is to examine NASA's responsibility under the Communications Satellite Act to launch INTELSAT satellites. We understand that the Working Group is now developing policies and plans for the assignment of commercial satellites to the Space Shuttle's launch manifest, and we hope that this contribution will prove helpful to the Working Group's deliberations.

Overview

The Communications Satellite Act directs NASA in express terms to furnish "satellite launching and associated services required for the establishment, operation and maintenance of the" INTELSAT system. While this directive is categorical on the face of the statute, we believe that the duty imposed on NASA by the Act can fairly be read: (i) as subordinate to launchings which might be ordered by the President for war or national defense purposes; and (ii) as coordinate with launchings of civilian government missions authorized by Congress. Nevertheless, Congress has imposed on NASA an affirmative obligation to launch INTELSAT satellites, a statutory entitlement which no other commercial satellite system can claim. This launch obligation is rooted in the express policy of the United States to foster and support the 109-nation INTELSAT system, and, therefore, merits heavy weight in the deliberations of the Working Group. To the extent the Space Shuttle's manifest is unable to accommodate the needs of all commercial operators, we submit that due regard for the provisions and policy of the Communications Satellite Act would require that the launch needs of INTELSAT be accorded precedence.

Statutory Analysis

As indicated above, the Communiations Satellite Act of 1962 (hereafter "Satellite Act" or "Act") establishes that it is the policy of the United States to foster and support the global commercial communications satellite system owned and operated by INTELSAT.[1] In order to help "achieve the objectives and carry

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[1] Communications Satellite Act of 1962, §§ 201 et seq., 47 U.S.C.A. §§ 701 et seq. (Pub. L. 87-624, 76 Stat. 419). This policy was recently restated and confirmed in section 146 of Pub. L. 99-93, 99 Stat. 425 (August 16, 1985),

(Continued on page 3)

out the purposes"[2] of the Satellite Act, NASA was directed to furnish specifically enumerated services to the Communications Satellite Corporation ("COMSAT") in its capacity as U.S. participant in INTELSAT. Most relevant in this regard is section 201(b)(5) of the Satellite Act, which provides that NASA "shall furnish to the corporation, on request and on a reimbursable basis, satellite launching and associated services required for the establishment, operation and maintenance of the [INTELSAT system]."[3] This statutory charge is unconditional on its face.

A review of section 201(b)(5) in the context of other NASA duties enumerated in section 201(b) underscores the importance that Congress attached to the launch obligation imposed upon NASA. Significantly, in every relevant subparagraph of section 201(b) except the above-quoted subparagraph (5), Congress employed terms of limitation, which modify the extent of the responsibility borne by NASA. Thus, NASA is to cooperate with the corporation in section 201(b)(2) - only "to the extent deemed appropriate ... in the public interest." NASA is also to assist the corporation

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(Continued from page 2)

[1] printed in 47 U.S.C.A. at § 701 (1986 Cumulative Annual Pocket Part).

[2] Communications Satellite Act at § 201, 47 U.S.C.A. at § 721.

[3] Section 305(b)(3) of the Communications Satellite Act, 47 U.S.C.A. § 735 (b) (3), also authorizes COMSAT to "purchase satellite launching and related services from the United States Government."

under 201(b)(3) -- insofar as "*the Administration deems necessary*." NASA is to furnish the services embraced by section 201(b)(6) -- " *to the extent feasible*." Only in the case of Section 201(b)(5), where NASA's duty to launch operational INTELSAT satellites is proclaimed, did Congress express its directive unqualifiedly. As a matter of statutory construction, this comparative analysis of the various subparagraphs of section 201(b), all of which are obviously *in pari materia*, reinforces the plain meaning of the Satellite Act -- specifically, that NASA is charged with furnishing satellite launching and associated services required for the operation and maintenance of the INTELSAT system.

Legislative History

The legislative history of the Satellite Act is comprised of hearings, committee reports and floor debates. A study of expressions of congressional intent concerning section 201(b)(5) -- which was written into the original satellite bill and survived the legislative process intact, without amendment -- adds emphasis to the conclusion that NASA is under a statutory directive to launch operational INTELSAT satellites, but suggests that this duty is less than absolute. However, there is little room for doubt that Congress intended to establish as policy for the United States that INTELSAT launches are to be given priority over other commercial launches in the event of conflicting claims on NASA's launch resources.

The importance ascribed by Congress to launch matters is developed extensively in the hearings. By and large the hearings deal generally with launch services in terms of their focal role in the successful establishment and operation of the proposed global communications satellite system, and in the attainment of the bill's objectives.[4/] However, section 201(b)(5) was addressed specifically in Senate hearings. Along these lines, Dr. Hugh L. Dryden, Deputy Administrator of NASA, testified that "another of NASA's functions in relation to the activities of the corporation will be to furnish satellite launching and associated services, including launch vehicles, in connection with the development and operation of the system. We will have two

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[4/] See Communications Satellite Legislation: Hearings Before the Senate Committee on Aeronautical and Space Sciences, 87th Cong., 2d Sess. (1962) (testimony of Dr. Hugh L. Dryden, Deputy Administrator, NASA, and Morton J. Stoller, Acting Director, Office of Applications, NASA), Communications Satellite Legislation: Hearings Before the Senate Committee on Commerce, 87th Cong., 2d Sess. (1962) (testimony of James E. Webb, Administrator, NASA); Communications Satellites - Part 1: Hearings Before the House Committee on Interstate and Foreign Commerce, 87th Cong., 2d Sess. (1961) (testimony of James E. Webb, Administrator NASA); Communications Satellites: Technical, Economic, and International Developments, Staff Report prepared for the Senate Committee on Aeronautical and Space Sciences, 87th Cong., 2d Sess. 77-82 (1962).

separate responsibilities in this respect, which are prescribed by sections 201 (b)(3) and (b) (5)".[5]

The congressional reports are to the same effect. Thus, the report of the Senate Commerce Committee states that "subsection (b) [of section 201] places certain responsibilities on the National Aeronautics and Space Administration. It is to ... furnish the corporation, on a reimbursable basis, launching and associated services required for the establishment, operation and maintenance of [the INTELSAT system]".[6] Similarly, the report of the House Committee on Interstate and Foreign Commerce indicates that "subsection (b) enumerates the responsibilities of the National Aeronautics and Space Administration in connection with the communications satellite system ... [NASA] would be directed to assist the communications satellite corporation in several ways. The Administration would ... furnish the corporation with satellite launching and associated services ... which are required (with the approval of the Federal Communications Commission) for the establishment, operation and maintenance of the system.[7]

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[5] Communications Satellite Act of 1962: Hearings Before the Senate Committee on Foreign Relations, 87th Cong., 2d Sess., 254 (1962).

[6] S. Rep. No. 1584, 87th Cong., 2d Sess. 15-16 (1962).

[7] H. Rep. No. 1636, 87th Cong. 2d Sess. 11 (1962).

The satellite bill was extensively debated, first on the floor of the House and then on the floor of the Senate. As regards the House debates,[8] Congressman Harris, Chairman of the Committee on Interstate and Foreign Commerce and House floor manager of the bill, delivered a detailed explanation of the proposed legislation, including section 201(b)(5). He stated: "We provide responsibility for [NASA] for the launching of the satellites and those things that go with launching .... We think that ... [NASA] in the national interest and in the interest of our future development, should assume its burden and responsibility.[9] And in a "carefully worked out section-by-section summary of the bill"[10] the Congressman added: "[NASA] would be directed to assist the communications satellite corporation in several ways .... The Administration would furnish the corporation with satellite launching and associated services ....[11]

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[8] For this purpose, the House resolved itself into a Committee of the Whole House on the State of the Union.

[9] 108 Cong. Record - Part 6, 7498 (May 2, 1962).

[10] Id. at 7500.

[11] Id. at 7501. Opponents of the bill construed section 201(b)(5) similarly. For example, see remarks of Congressman Green ("Under the terms of the legislation now before us ... the Government would furnish launching vehicles, launching crews, and supporting services. It would launch the satellites."), 108 Cong. Record - Part 6, of 7526 (May 2, 1962), and Congressman Ryan ("I should like to point out that in the conduct of this system ... the Government will have to furnish the launch vehicles; the

(Continued on page 8)

The apparent unconditional nature of NASA's launch duty provoked considerable discussion during the Senate debates. There opponents of the bill contended that section 201(b)(5) reflected an absolute statutory command that would preempt NASA's launch resources even if otherwise required for war missions or other national defense purposes. This extreme interpretation was subsequently disclaimed by Commerce Committee Chairman and Senate bill floor manager, Senator Pastore.

The exchange was opened by bill opponent, Senator Kefauver, who read to the Senate section 201(b)(5). He continued:

> If the corporation should start with the low-orbit system, NASA would have no discretion, but would have to cooperate and furnish boosters when the corporation wanted them, no matter how

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(Continued from page 7)

11/ Government will have to launch the satellites and provide crews and associated services for the launching .... . "Id, at 7513 and 7522. See in addition the remarks of Congressman Springer ("[T]he responsibilities of [NASA] ... are clearly defined.") Id, at 7502-7503.

> many that might be, and no matter what kind of adverse effect there might be on our space program. Boosters might be needed for that. Boosters might be needed for war or defense purposes. We are asked to write into law such a provision, no matter what the situation might be, no matter what great national emergency we might face. Regardless of the situation, NASA would have to furnish the corporation the boosters whenever the corporation called for them.[12]

On this basis Senator Kefauver and other bill opponents introduced various proposed amendments to section 201(b)(5) designed to qualify NASA's launch obligation.[13] All of these amendments were defeated. However, Senator Pastore, as bill floor manager, submitted extended remarks for the record in response to Senator Kefauver, for the purpose of "avoid[ing] any misunderstanding as to the intention and meaning"[14] of the bill's provisions. Concerning section 201 (b) (5) and "the duty of NASA to provide launching services to the corporation for operational satellites," be stated:

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[12] 108 Cong. Record-Part 12, at 16240 (August 11, 1962). See also Senator Kefauver's extended remarks at 108 Cong. Record-Part 12, at 16899 (August 17, 1962).

[13] One amendment would have required NASA to launch operational INTELSAT satellites only "to the extend deemed appropriate by the Administration in the public interest." 108 Cong. Record - Part 12, at 16221 (August 11, 1962). (emphasis supplied.) Another would have stipulated that "[NASA] shall furnish aid, assistance, service, and facilities to or for the corporation in compliance with [section 201(b)] under such terms and conditions as it shall prescribe with the approval of the President." Id. (emphasis supplied). A third proposed amendment would have deleted the phrase "on request" in section 201(b)(5) and substituted in lieu thereof the phrase "when appropriate." 108 Cong. Record - Part 12, at 16849 (August 17, 1962). (emphasis supplied). A fourth would have added to the end of section 201(b)(5) the phrase "unless the Administration determines that the provision of such services is not in the public interest." Id. at 16858. (emphasis supplied).

[14] 108 Cong. Record - Part 12, at 16870 (August 17, 1962).

> [T]he provision in question quite obviously could not reasonably be construed as obligating NASA to launch satellites at the corporation's request in disregard of its other legal functions and the powers and duties of the President. Specifically launching operational satellites for the corporation would be subordinate to launchings which might be directed by the President as Commander in chief for war or national defense purposes, and in addition system launchings would have to be scheduled in relation to NASA's launchings under other space programs as authorized by Congress.[15]

Although this construction is of intepretative significance, it must be reconciled with the express provisions of the Satellite Act and with the other authoritative evidences of congressional intent set forth above.[16] The reading of the statute which synthesizes the plain language of section 201(b)(5) with the whole underlying legislative record is that the Satellite Act places an affirmative statutory obligation on NASA to launch operational INTELSAT satellites, subordinate only to national security requirements and coordinate only with other NASA launch requirements pursuant to space programs specifically authorized by Congress. As a corollary, as shown below, this establishes that INTELSAT launchings are entitled by statute to precedence over other commercial satellite launchings if all such launches cannot be coordinated on NASA's manifest.

---

[15] 108 Cong. Record - Part 12 at 16871 (August 17, 1962).

[16] See especially the statutory construction rendered by House floor manager Harris (which is entitled to equal interpretative weight as the explanation of the Senate floor manager), set forth at p. above: "We provide responsibility for [NASA] for the launching of the satellites and those things that go with launching .... [NASA] in the national interest and in the interest of future development should assume its burden and responsibility."

COMSAT Is Vested With Launch Priority For INTELSAT Operational Satellites

Of course, the clearest evidence that INTELSAT launch needs should be afforded precedence over other commercial systems derives from section 201(b)(5), which creates launch rights in COMSAT on behalf of INTELSAT. No other commercial satellite system operator can claim a similar statutory entitlement.

Additional light on this issue was shed by NASA during Senate hearings.[17] As the following exchange between Dr. Hugh L. Dryden, Deputy Administrator of NASA, and Senator Gore makes plain, NASA viewed section 201(b)(5) as establishing a preferred position for INTELSAT satellite launches.

---

[17] NASA's contemporanious interpretation of the Satellite Act is authoritative, since it participated in the formulation of the satellite bill and supported its passage. See in the latter regard, Communications Satellite Act of 1962: Hearings Before the Senate Committee on Foreign Relations, 87th Cong. 2d Sess. 255-256 (1962); 108 Cong. Record - Part 6, at 7497-98 (May 2, 1962) (statement of House floor manager Harris).

> Dr. Dryden. If the bill passes and the corporation is set up, I think we would interpret this desire to contribute to the early realization of an operational system to mean that we would cooperate -- in accordance with the provisions in the bill before you -- with the corporation, and that this would --
>
> Senator Gore. Exclusively?
>
> Dr. Dryden. So far as this offer that I just spoke of, of launching satellites for private interests, so to speak.
>
> Senator Gore. In other words, if this bill passes, then it will be the position of the Space Administration that you would not enter into negotiations with any other American citizen or American concern for the launching of communication satellites? Did you not put that way in your statement?
>
> Dr. Dryden. Yes.
>
> Senator Gore. All right.
>
> Dr. Dryden. I still stand by it. I say that our judgments would be made in the national interest.
>
> Senator Gore. I just want to know if that is what you mean.
>
> Dr. Dryden. I think this is a fair statement.
>
> Senator Gore. Now, do you wish to add anything further?
>
> Dr. Dryden. I say that the primary concern is that of the national interest.

> If a situation should develop, as I do not foresee, the Government having set officially a corporation to establish a communications system around the world, if in spite of this somehow there was a development which indicated that the national interest was to be served by doing something different, I think we would consider it. But I believe unless the Congress established another provision for another operating communications system, there would be nothing to be gained by NASA offering its services to other--
>
> Senator Gore. Please understand, Dr. Dryden, that I am not being critical of you, nor am I attempting to be critical of you. I have no desire to do so. I think you have clearly established the fact in your testimony that under present law, research and development will continue, and that the opportunity for research and development, for further enterprise in this field, is open. Moreover, that the services of your agency are open for cooperation with any company or citizens having the requisite technical capabilities.
>
> You have established that if Congress passes this bill, you will interpret it as the will and intent of the Congress with regard to the law. Therefore you would confine your cooperation and your launchings to this particular corporation.
>
> Dr. Dryden. May I take an example from the past?
>
> Senator Gore. Is that a correct summation?
>
> Dr. Dryden. That is correct.[18]

Other indications of congressional intent are consistent with NASA's interpretation. Thus, during Senate debates the Gore-Dryden exchange was read to the full Senate[19] and no Senator took issue with NASA's understanding as to the "will and intent of Congress". Further, during the House debates Congressman Ryan observed that "only th[e] corporation is statutorily entitled as a matter of right to the NASA services set out in section 201(b)."20/ Finally an effort to amend Section 201(b) to provide that NASA shall "furnish the same services .... on the same basis to any other commercial satellite communications system which may be established"21/ was defeated. Consequently, indications are conclusive that, in circumstances where NASA lacks the launch capability to accommodate every commercial satellite operator, INTELSAT's launch requirements must be accorded precedence.

---

[18] Communications Satellite Act of 1962: Hearings Before the Senate Committee on Foreign Relations, 87th Cong., 2d Sess. 265-266 (1962). (emphasis supplied).

[19] See remarks of Senator Long, 108 Cong. Record - Part 12, at 16215 (August 11, 1962).

Conclusion

Congress has declared that the Space Shuttle "should serve commercial users."22/ Congress has also declared that NASA is to launch operational INTELSAT satellites. Based upon the analysis set forth in this White Paper, it is submitted that Space Shuttle launch capacity should be made available for INTELSAT spacecraft, subject to national security considerations and on a basis coordinate with civil government missions. INTELSAT's launch precedenced over other commercial operators is established by statute, as well as by U.S. policy to foster and support the INTELSAT system.

20/ 108 Cong. Record - Part 13, at 17677 (August 27, 1962).

21/ 108 Cong. Record - Part 12, at 16856 (August 17, 1962 (emphasis supplied).

22/ National Aeronautics and Space Administration Authorization Act of 1986, Section 201(3), Publ L. 99-170, Title 11 (99 Stat. 1017), 42 U.S.C.A. § 2466 (1986 Cumulative Annual Pocket Part).

DEVELOPING A U.S. ELV CAPABILITY -
APPENDIX #1

SST
SCOTT SCIENCE AND TECHNOLOGY
858 West Jackman, Suite 202, Lancaster, CA 93534

805-945-1877

August 4, 1986

Mr. Thomas N. Tate
Counsel
U.S. House of Representatives
Committee on Science and Technology
Washington, D.C. 20515

Dear Tom:

As we all continue to address the issues, I thought you might be interested in the enclosed letters to Dr. Fletcher, July 21, 1986, and to Jerome Simonoff of Citicorp, August 4, 1986; perhaps there is a convergence to a near term interim solution to providing the commercial sector with space transportation on a competitive basis.

Keep up the good work and let us know if we can provide any manner of assistance.

Best personal regards,

David R. Scott
President

DRS/ma
Enclosures: A/S
SN/6379

RECEIVED
AUG 1 1 1986
COMMITTEE ON SCIENCE
AND TECHNOLOGY

SST
SCOTT SCIENCE AND TECHNOLOGY
858 West Jackman, Suite 202, Lancaster, CA 93534

805-945-1877

July 21, 1986

Dr. James C. Fletcher
Administrator
National Aeronautics and
  Space Administration
Washington, D.C. 20546

Dear Dr. Fletcher:

As a result of existing U.S. Government policies regarding commercial space activities as well as NASA initiatives responding to such policies, several U.S. companies, both public and private, have initiated programs and made substantial investments related to the commercial launch and delivery of satellites to transfer or destination orbits. Specifically, and for the purpose of this letter, such commercial launch companies are defined as those companies that have initiated the development or procurement of a launch vehicle consisting of one or more rocket propulsion stages. Scott Science and Technology, Inc., is one such company.

Within the current reassessment of the U.S. Space Program, it is recommended that these commercial launch companies be considered as a specific business sector to which the emerging Government policy regarding the commercial launch of satellites, which includes the launch of commercial satellites, be applied with consistency of principle. Specifically, if within a technical and operations concept of satellite launch and delivery, which has been approved by NASA, certain unique government facilities, equipment and personnel are essential for mission success, but are unavailable to the commercial launch company or impractical to acquire, then it is recommended that such facilities, equipment and personnel be made available to the commercial launch company on a cost reimbursable basis, subject to terms and conditions of a proper agreement.

In accordance with such a policy, not only will the commercialization of satellite launch and delivery be enhanced, but also the U.S. Government will be excluded from itself launching e.g., commercial satellites, in that applicable Government facilities, equipment and personnel will be utilized by one or more commercial launch companies, and hence will not be used by the Government in competition with the commercial sector.

Further, the established U.S. Government policies and commitments relative to those commercial ventures which have initiated the business of satellite launch and delivery will remain effective and viable, and the Government will have opened a new and broader avenue of support for the commercial space enterprise.

Sincerely,

David R. Scott
President

DRS/ma
SN/6364

SST
SCOTT SCIENCE AND TECHNOLOGY
858 West Jackman, Suite 202, Lancaster, CA 93534
805-945-1877

August 4, 1986

Mr. Jerome Simonoff
Vice President
Citicorp Industrial Credit, Inc.
450 Mamaroneck Avenue
Harrison, New York 10528

Dear Jerry:

To continue our dialogue on the various aspects of the financing and commercialization of space, I have recently had the opportunity to review your enlightening article, "Creating a U.S. Arianespace", in *Aerospace America*, July 1986. I believe your scheme is sound and has considerable merit; and I also believe that implementation of an "interim measure" of the scheme could commence in the near term to not only enhance the present situation but also to perhaps accelerate the final resolution of providing "the government and commercial sectors with space transportation on a competitive basis".

In your article you identify "several basic problems facing such a scheme" which will most likely require considerable time and effort to resolve. To initiate positive action in the near term, perhaps such an interim measure could be adopted which would have three primary objectives: 1) avoid these time consuming, albeit important, problems for the present; 2) enable a stepwise preparation in the formation of a "national transportation company"; and 3) enable the U.S. commercial sector to begin scheduling the launch of commercial payloads using "all present American launch vehicles". (The model for this interim measure is the present Transpace Carriers approach to commercializing the Delta, thus a precedent has been formulated). Consider the following:

As a result of existing U.S. Government policies regarding commercial space activities as well as NASA initiatives responding to such policies, several U.S. companies, both public and private, have initiated programs and made substantial investments related to the commercial launch and delivery of satellites to transfer or destination orbits. Specifically, and for the purpose of this letter, such commercial launch companies are defined as those companies that have initiated the development or procurement of a launch vehicle consisting of one or more rocket propulsion stages. Scott Science and Technology, Inc., is one such company.

Within the current reassessment of the U.S. Space Program, it is recommended that these commercial launch companies be considered as a specific business sector to which the emerging Government policy regarding the commercial launch of satellites, which includes the launch of commercial satellites, be applied with consistency of principle. Specifically, if within a technical and operations concept of satellite launch and delivery, which has been approved by NASA, certain unique government facilities, equipment and personnel are essential for mission success, but are unavailable to the commercial launch company or impractical to acquire, then it is recommended that such facilities, equipment and personnel be made available to the commercial launch company on a cost reimbursable basis, subject to terms and conditions of a proper agreement.

In accordance with such a policy, not only will the commercialization of satellite launch and delivery be enhanced, but also the U.S. Government will be excluded from itself launching e.g., commercial satellites, in that applicable Government facilities, equipment and personnel will be utilized by one or more commercial launch companies, and hence will not be used by the Government in competition with the commercial sector.

Further, the established U.S. Government policies and commitments relative to those commercial ventures which have initiated the business of satellite launch and delivery will remain effective and viable, and the Government will have opened a new and broader avenue of support for the commercial space enterprise.

Implementation of this policy by the Government will accomplish the three primary objectives of the proposed interim measure supporting the eventual formation of the eventual transportation company as follows. First, the problem of mixed government and commercial ownership is avoided for the present. Competitive suppliers and users would not yet be operating collectively. Government agencies would still be controlling their own launch vehicles. And insurance would be the responsibility of the commercial launch company providing the launch service.

The second objective of the interim measure would also be accomplished by this commercial launch company policy in that the identified commercial launch companies (perhaps formally by NASA) would become the initial "owners" and representatives of the national transportation company and thus would be in a qualified and experienced position to actively participate in the eventual official formation of the national transportation company.

Accomplishment of the third objective of the interim measure would partially implement the charter you have proposed for the national transportation company in that commencing the actual scheduling of commercial payload launches would provide "the commercial sector with space transportation on a competitive basis". Additionally, it is very likely that once the commercial launch companies are in place and operating, the government would also elect to utilize such launch services, thus consummating the original proposed charter for the national transportation company.

This interim approach to the formation of the national transportation company would also enhance the activities and initial progress of the task force you have suggested for the evaluation and preparation of the formal scheme in that it would among other things, provide a framework within which the several complex issues and problems associated with the broader objectives could be more effectively addressed. In particular, it appears that considerable task force discussion will ensue on the subjects of joint government and commercial ownership of the national transportation company as well as the concept of allowing "its individual owners or others to offer launch services in competition with the company".

And finally, I believe a major issue in the formation of the national transportation company will be "who's in charge", a situation afflicting the entire U.S. space program and so aptly described in the Editorial of Aviation Week and Space Technology, July 28, 1986. As one solution to this problem, and as part of my response to the National Commission on Space earlier this year, I would recommend the appointment of an advisor to the President (directly), who is also the National Director of Space Activities, to lead and coordinate the many Government agencies which now conduct major space and space-related activities. Such a Director would also clearly be in a position to lead the formation of the national transportation company.

Good luck in your continuing efforts to establish the U.S. as the leader in commercial space, an essential element to maintaining our overall leadership in international space activities, and aspirations. Please let me know if we can be of any assistance, and I look forward to a continuing dialogue.

Sincerely,

David R. Scott
President

DRS/ma
Enclosures: A/S
SN/6373

DEVELOPING A U.S. ELV CAPABILITY -
APPENDIX #2

Astrotech Space Operations, Inc.
12510 Prosperity Drive
Silver Spring, Maryland 20904
301-622-5804
Telex 380143

ASTROTECH

12 August 1986

The Honorable Bill Nelson
U.S. House of Representatives
307 Cannon House Office Building
Washington, DC 20515

Dear Congressman Nelson:

We applaud and support your efforts to get the U.S. space program back on track. In particular, we endorse the proposed amendment to the Commercial Space Launch Act (P.L. 98-575) that is currently being considered by the Subcommittee on Space Science and Applications. In addition to our personal interest in and concern for the current state of the U.S. space program, as owner and operator of the Nation's first commercial payload processing facility in Titusville, Florida, we have been directly affected by the aftermath of the CHALLENGER accident and the virtual loss of direction in the U.S. space program.

Since our Titusville facility was designed to support payloads launched on both Shuttle and Expendable Launch Vehicles (ELV's), we support the revitalization of the U.S. ELV capability to augment the Shuttle capability. But, obviously, we are unable to support satellites that are launched on foreign ELV's. At the time of the CHALLENGER accident, over a dozen foreign and commercial satellites were scheduled for launch on the Shuttle just through the end of 1987, the majority of which were slated to be processed at our facility. With no Shuttle launches available and no viable (including cost competitive and timely) alternative U.S. ELV program, these customers will have little choice other than to seek launch services outside the U.S. in order to protect their own commercial interests.

Since the CHALLENGER accident, we have already witnessed the exodus of five payloads from U.S. launchers to Ariane. These five payloads were expected to use our Titusville facility and alone will result in $3.6 million in lost revenues to Astrotech Space Operations during the next three years, which represents most of the projected profit for this period. As a small, commercial operation it will be a struggle for us to survive, and any further losses due to a continuing payload exodus could prove devastating to this commercial venture.

Therefore, we seek your support as both the elected representative from the 11th Congressional District of Florida and an advocate of commercial space activity to initiate immediate and decisive action to reinvigorate both the Shuttle and U.S. ELV programs. For without prompt action to provide a timely and commercially competitive means to launch foreign and commercial payloads from the U.S., we will witness the total dismemberment of the dominant position that has so long been held by the United States as the leader in providing launch services to foreign and commercial payload owners. Along with the resulting loss of prestige will be a significant loss of foreign revenues and increased U.S. corporation expenditures abroad.

With regard to the proposed legislation, we are in complete agreement with the "givens" cited and would offer for the Subcommittee's consideration the following comments on several of the items in the draft Commercial Space Launch Policy (copy enclosed):

Item 2. The Commercial Space Launch Act (P.L. 98-575) should be amended to provide access to government launch facilities at additive rather than direct cost.

While we wholeheartedly support additive costing as probably the only means to enable development of a commercially viable U.S. ELV industry, we would urge careful wording of this provision to preclude the possibility of interpreting "launch facilities" to include payload processing facilities. It would be impossible for Astrotech, with its commercially developed and operated payload processing facility, to compete with another commercial operator who, under such an interpretation, might arrange to assume commercial operation of the government payload processing facilities on an additive cost basis. Possible wording to preclude a misinterpretation would be the addition of the following at the end of this statement, "..., except where facilities (such as payload processing facilities) are commercially available."

Item 3. The Shuttle Pricing Policy for foreign and commercial users (Title II, P.L. 99-170) should be amended as necessary to have the price for a Shuttle launch be not less than the price for a comparable U.S. ELV launch. NASA should continue to provide incentives for research use of the Shuttle through the Joint Endeavor Agreement program. Special cost arrangements (e.g., deferred payments of launch costs) should be continued, when appropriate.

With regard to Shuttle pricing, we fully agree that a viable U.S. commercial ELV program cannot succeed if it is forced to compete with lower priced Shuttle launches. However, those who suggest that a viable U.S. commercial ELV industry can be spawned by simply raising the Shuttle price or banning foreign and commercial payloads from use of the Shuttle are not mindful of NASA's difficult experience competing with the Ariane, even with "low" Shuttle prices. GTE and Western Union based their selection of Ariane launches over Shuttle launches primarily on one significant difference between the two launcher systems --

price. While representatives of both companies stated that they would have preferred to use a U.S. launcher (and Western Union was later won back with "special considerations" offerred by NASA), as publicly traded commercial corporations they felt a duty to their shareholders which outweighed their patriotic desires. Since a government need (the USAF GPS Program) has already been identified as requiring the class of launcher also needed to launch foreign and commercial satellites, a real solution to the challenge of assuring commercial viability of a U.S. ELV industry would be to permit the operator of the launch vehicle selected for GPS to offer use of that ELV for foreign and commercial payloads at a price also based on additive cost. This would result in pricing that would favor such an ELV over Shuttle, be competitive with Ariane (and the other developing foreign launcher systems), and not represent a financial burden to the U.S. taxpayer (since the government requirement for a GPS launcher has already been established).

Item 4. To discourage NASA from active pursuit of commercial customers for the Shuttle, all revenues obtained from foreign and commercial Shuttle users which exceed the full cost of providing the service (currently estimated at $74 million in 1982 dollars) will revert directly to the general fund of the U.S. Treasury.

We would urge full and careful consideration by the Subcommittee before proposing a total, unequivocal ban on commercial use of the Shuttle. If efforts are taken to ensure the ability of a U.S. commercial ELV operator to price an ELV launch below that of a Shuttle, as discussed above, the normal forces in the commercial marketplace will cause satellite owners to give the U.S. ELV priority consideration, without the need for additional legislation to ban the use of the Shuttle for foreign and commercial satellite launches. This approach would achieve the desired purpose espoused by the Subcommittee to foster development of a U.S commercial ELV industry, while retaining the flexibility of commercial satellite customers to utilize the Shuttle when situations, such as a crowded launch schedule, arise that warrant the extra customer expense of selecting a Shuttle launch. Clearly, the foreign and commercial satellite owner community has demonstrated their desire for an ELV launch rather than a Shuttle launch, given acceptable ELV pricing and schedule conditions.

In addition, to take action to discourage NASA from active pursuit of commercial customers for Shuttle will thwart the continuing evolution of comercial space activity, much of which is dependent upon access to the Shuttle for not only spaceborne research, but also eventually for spaceborne manufacturing of commercial products by commercial organizations. Since the U.S. manufacturing community has demonstrated neither a sense of the possibilities for spaceborne manufacturing nor been inclined to enter such a speculative arena with many years before the possibility of economic payback, a government advocate is also required in this area. Without government advocacy and support, the U.S. will permanently lose leadership in this very important area. The West German and Japanese governments have clearly indicated the importance they place on the development of spaceborne manufacturing and its future commercial profitability. We would suggest that the Subcommittee take this opportunity to renew the government's commitment to foster the advance of space commercialization by encouraging, rather than discouraging, NASA's pursuit of commercial customers for the Shuttle, as the government expert in space activity.

In closing, we are very concerned about the apparent lack of appreciation demonstrated in public and private comments by representatives of the Departments of Transportation and Commerce, and certain Administration officials for the reality of foreign commercial competition in space. Unless the U.S. space program can be immediately renewed through efforts such as yours and the Subcommittee, history will judge us not so much for the fact that there was a Shuttle catastrophe, but for the fact that in the aftermath the United States totally lost its resolve and direction to vigorously pursue the exploration and utilization of space. Please call upon us if there is any way in which we can be of further assistance in this effort.

Respectfully,

Robert J. Goss

Robert J. Goss
President

Enclosure

ommercial Space Launch Policy

Givens

The U.S space program (governmental and industry) must provide reliable access to space for all U.S. users, including manned use.

A mixed fleet of the Shuttle and ELV's is required to assure reliable access to space.

The U.S. government should honor existing commitments to launch commercial payloads on the Shuttle, unless the commercial customers desire to use an expendable launch vehicle alternative. The Shuttle should remain available to commercial users as a back-up vehicle.

America cannot concede the ELV launch service business to foreign competition.

Private industry has, to date, not developed a commercial ELV industry. Some government steps must be taken to provide a climate in which U.S. commercial ELV's can be competitive. The minimum long term government involvement/support is preferred.

Recognizing the need to provide policy direction to promote and encourage the development of a commercial ELV industry, the following would be included in a bill to establish that policy direction:

1. NASA must purchase, through a competitive procurement, at least 15 launches (not vehicles) capable of placing up to 2800 pounds in geosynchronous transfer orbit for government payloads aggregated by NASA. These launches should be purchased over a 5 year period beginning in 1988 and should occur at a rate of at least 2 per year.
2. The Commercial Space Launch Act (P.L. 98-575) should be amended to provide access to government launch facilities at additive rather than direct cost.
3. The Shuttle Pricing Policy for foreign and commercial users (Title II, P.L. 99-170) should be amended as necessary to have the price for a Shuttle launch be not less than the price for a comparable U.S. ELV launch. NASA should continue to provide incentives for research use of the Shuttle through the Joint Endeavor Agreement program. Special cost arrangements (e.g., deferred payments of launch costs) should be continued, when appropriate.
4. To discourage NASA from active pursuit of commercial customers for the Shuttle, all revenues obtained from foreign and commercial Shuttle users which exceed the full cost of providing the service (currently estimated at $74 million in 1982 dollars) will revert directly to the general fund of the U.S. Treasury.
5. It is the sense of the Congress that the private insurance industry should be encouraged to establish an "Underwriters Laboratory" equivalent which would monitor ELV quality assurance and reliability. Such an organization would assist in more accurately assessing risk and thus minimizing risk exposure.

DEVELOPING A U.S. ELV CAPABILITY -
APPENDIX #3

AMERICAN ROCKET COMPANY

6 September 1986

The Honorable Bill Nelson, Chairman
Subcommitee on Space Science and Applications
Suite 2321, Rayburn House Office Building
Washington DC 20515-6301

1986

Dear Mr. Chairman:

Thank you for your letter of August 20th. My staff and I have reviewed the text of H.R. 5469 as enclosed in your letter. In my testimony on August 14th, I noted a number of objections to the proposed initiative on which we were invited to comment. Those objections are still applicable to the current legislation, as are many of the points raised by the other space transportation providers who testified along with me.

In particular, I would reiterate the point that the introduction of NASA as a third party into the process of purchase of launch service by Government agencies from the private sector seems unneccesary and potentially cumbersome. NASA, and for that matter the Departments of Transportation and Commerce are always available in an advisory role should the customer agency feel that it needs additional expertise to effect the purchase of launch services; a mandated role for NASA in this purchase process would be overkill.

The idea of using the Government's purchasing power to stimulate the commercial space transportation industry is an excellent one, and would constitute a valuable aid in combatting foriegn subsidized competition. I would suggest that given the recently announced cutbacks in Shuttle launch service, which threatens to decimate NASA's science missions, that at least 15 launches in the various payload size ranges could be purchased by NASA for NASA's own use, particularly if some of the payloads scheduled to be launched in Spacelab or in the Shuttle mid-deck were to be reconfigured as free-flying paylaods. This would deliver two highly worthwhile benefits, not only aiding the commercial space transportation industry, but also salvaging some of NASA's science missions and helping to regain American leadership in this field.

Thank you for your attention. I hope to continue discussion with you on these vital topics.

Yours sincerely,

George A. Koopman

George A. Koopman
President, American Rocket Company

3575 B Haven Avenue • Menlo Park, CA 94025 • 415-361-1410

DEVELOPING A U.S. ELV CAPABILITY -
APPENDIX #4

european space agency
agence spatiale européenne

Hon. Bill Nelson
Chairman
Subcom. on Space Sci. & Applications
Committee on Sci. & Technology
2324 Rayburn House Office Building
Washington, D. C. 20515

Ref. #: 201/1580
September 12, 1986

Dear Sir:

It has come to the attention of the European Space Agency (E.S.A.) that, in the course of hearings held by your subcommittee on "Commercial Space Launch Policy" a statement was made in testimony submitted by Mr. Alan B. Parker of Ford Aerospace and Communications Corporation, to the effect that "...when competition again presents itself, Arianespace will price primarily to recover their actual recurring and operating costs (which continue to be subsidized by about 30 percent of E.S.A.'s total yearly budget). The non-recurring costs will have long before been written off. No truly commercial company can stay in business with such a pricing policy".

E.S.A. wants to avoid that a complete misunderstanding of its mission and of its relationship with Arianespace be created by this statement, and I have therefore been directed to provide you with the following information as concerns the true situation.

The E.S.A. is an intergovernmental organization of 13 European States (as from 1 January 1987) which conducts research and development programmes on behalf of its member states. Amongst these programmes are those related to Ariane. To date, E.S.A. has carried out the development of the Ariane programmes 1, 2 and 3 and is currently developing the Ariane 4 programme. The Ariane 5 preparatory programme has also been agreed upon. However, following development and qualification of the various "generations" of the vehicle, the manufacturing, marketing and launching of operational vehicles becomes the responsibility of Arianespace which is, as you are aware, a commercial company incorporated under French law.

If we take an average figure for the various E.S.A. Ariane programmes and compare this sum to the overall yearly E.S.A. budgets (Science, Telecommunications, Earth Observation, Columbus Microgravity, etc.), we obtain the aforementioned figure of 30%.

However, these funds are spent by the Agency on launcher development and in no way, whatsoever, is any of this "30% of E.S.A.'s budget" allocated to Arianespace. We therefore reject totally any implication that E.S.A.'s Ariane programme activities might be characterised as a subsidisation of Arianespace.

This issue has already been exhaustively evaluated by the office of the U.S. Trade Representative in the course of international consultations between E.S.A. and the U.S.T.R. arising out of a petition brought against arianespace by Transpace Carriers, Inc.

As a result of the U.S.T.R. investigation a determination was made under section 301 of the Trade Act of 1974 that:

> "The practices of the member states of the European Space Agency (ESA) and their instrumentalities with respect to the commercial satellite launching services of Arianespace, S.A. are not unreasonable and a burden or restriction on U.S. Commerce".

The Agency welcomes the opportunity to clarify this matter and would appreciate the inclusion of this letter in the relevant hearing record, if at all possible.

Yours sincerely,

Ian W. Pryke
Head, Washington Office

DEVELOPING A U.S. ELV CAPABILITY -
APPENDIX #5

Transpace
Carriers Inc

Transpace Carriers, Inc
5900 Princess Garden Parkway
Suite 450
Lanham, MD 20706

301-982-7800

September 15, 1986

Honorable Bill Nelson
Chairman
Subcommittee on Space Science
and Applications
U.S. House of Representatives
Suite 2321 Rayburn House Office Building
Washington, D.C. 20515-6301

Dear Mr. Chairman:

Reference your letter of August 20, 1986. On behalf of Transpace Carriers Inc., I wish to thank you for the opportunity to appear before your Subcommittee on August 14, 1986 to discuss the principal issues relating to commercialization/privatization of the launch vehicle industry in the United States. I also applaud your efforts to develop legislative initiatives designed to stimulate this industry with the overall objective of providing users (both domestic and foreign) with a broad base of qualified launch services opportunities operated by domestic U.S. companies.

Since our testimony, the President has announced his overall policy to refocus NASA's efforts on research, exploration and space development as well as to develop a fourth orbiter for NASA. At the same time, the President has clarified NASA's reduced role in the launch vehicle world and set down strong guidelines for establishment of a playing field where the U.S. Government will not compete with commercial launch service providers.

In its testimony, Transpace pointed out that a principal issue in developing an effective and viable commercial launch services industry would be the good faith implementation by the U.S. Government of transition arrangements to facilitate entry by the private sector. We emphasized to your Committee the need for the Government to deal fairly with the commercializing companies and we expressed our frustration at achieving privatization agreements with the Government in an expeditious time frame - reciting our four-year Odyssey to effect same with NASA.

Since your Subcommittee Hearings and the President's pronouncement, we have seen little progress on this front and accordingly request your Subcommittee to take whatever action it can to ensure that the Government lives up to its good faith obligation to those companies who have worked to develop a commercial launch services industry. As you know, the speed and decisiveness of implementation activities are often the test of whether a policy will be effective or not. Transpace has customers with satellites built and waiting Delta class launch. NASA's unwillingness to move forward, finalize negotiations and implement appropriate privatization agreements are preventing Transpace from providing launch services to those customers -- thus forcing these customers either to delay their business plans or seek launch capability outside the United States. Neither of these courses of action is in the best interests of the country.

We are prepared to meet with you or your staff at your earliest convenience to discuss effective action by your Subcommittee to help achieve our common objective of assured access to space.

Sincerely,

John F. Dealy

John F. Dealy
Senior Advisor to
Transpace Carriers Inc.

JFD/mbv

DEVELOPING A U.S. ELV CAPABILITY -
APPENDIX #6

IRDS
Institute for Research &
Development of Spacenology
P.O. BOX 328, WESTMINSTER, MA 01473

19 August 1986

Gloria Boswell
Subcommittee on Space Science and Applications
Room 2324, Rayburn House Office Building
Washington, DC 20515-6301

Dear Ms. Boswell:

Enclosed is our statement for the hearing record, as requested by Congressman Nelson in his letter to us of August 6. 1986.

Please ensure that we are on the distribution list for copies of the hearing recored. If possible we would like to get two copies for our records. Thank you for your assistance.

Sincerely

ROBERT L. STRAITT
Director

ss
enclosures

IR DS
Institute for Research &
Development of Spacenology
P.O. BOX 328, WESTMINSTER, MA 01473

18 August 1986

Congressman Bill Nelson
Subcommitte on Space Science
  and Applications
Suite 231 Rayburn House Office Building
Washington, DC 20515-6301

Dear Congressman Nelson and Members of the
     Subcommittee on Space Science and Applications:

The Institute for Research and Develoment of Spacenology, Ltd., is a non-profit corporation founded in August of 1985 to stimulate and support commercial space ventures. Since that time we have been activily supporting industrial/acadamic joint programs in the commercial development of space. Presently, we are working to develop a United States' Commercial Launch capability, through an industry/accadamia consortium effort. By pooling resourcs in a cooperative effort we hope to establish the infra-structure neccassary to make regular commercial launches a reality. From our position as a leader in innovative approaches to joint commercial space ventures, we present the following as our statment, for inclusion in the hearing record, as you have requested.

NASA seen from the commercial sector:

The current image of NASA, amongst industry and academia is not good. NASA has transgressed from its well thought of role as stimulator and research facilitator to that of burocratic inhibator. From its inception, through the Mercury, Gemini, and Apollo programs, NASA was a developer of new technology, a guardian of pure and applied research, and a team player in the conquest of space. Then came the shuttle and NASA became a trucking company, with the close mindedness of a burocratic giant, that it had become. NASA systematically began to smother the flame, for which it was created to kindle.

NASA can still be the viable stimulator to commerce that it once was and can do more to support commercial space activity then any other government agency, if it is rechartered to do so. As a generator of new space goals and leader in high risk research NASA can instill a new life into the American Space Industry. We offer the following recommendation for consideration in your legislative package.

1) NASA should use commercial launch vehicles when available to place routine government payloads into orbit and should defer commercial customers' to the private sector when the private sector can support the customers requirements. The shuttle should be used for those payloads that cannot be accomindated by commercial launch vehicles and as the primary U.S. vehicle for for research programs.

2) Fees for launching commercial payloads on the shuttle should reflect fair market cost of the services and should include all associated cost of the launch. It is important to the effective stimulation of the private sector, that this issue be settled and that a new price structure be in force by the time NASA resumes shuttle launches.

3) Those funds that are in excess of the actual cost to the government, to launch commmercial payloads, should be diverted into a special fund that will support pure and applied research in the space sciences, with the exclusion of funding, operating cost for NASA non-research and vehicle development programs.

Government stimulation of the Launch Industry:

Although the government can remain most stable through the use of burocratic management, industry must be flexible to the needs of the consumer. Grovernment should therefore refrain from playing a directive role in the development of the Commercial Launch Industry and play a supportive role by forming policy that will reduce or eliminate the roadblocks to the Launch Industry's development. Legislative action should be taken to:

1) Provide ready availability to government launch and ground support/tracking facilities for all U.S. Commercial Launch companies. The cost for the use of these facilities should be charged on a "cost plus" basis. A portion of those proceeds, in excess of the actual cost for providing these services, should be directed to a special fund that will be administered by a publicly supported and government chartered institution, for the purpose of establishing self-supporting facilitites, to provide commercial access to space.

2) Provide incentative and controlling measures for the insurance industry. This legislation should limit the civil

liabilities and awards for damages to reasonable and prudent amounts. Punitive awards should be allowed only in those cases in which gross negligence and/or willfull and complete disregard for public safety are involved. Establish an insurance rate structure that will allow for maximum competition while preventing overpricing. This structure should be established and maintained by a board consisting of an equal number of representatives from Congress, the Insurance Industry, Academia and the Commercial Space Industry. A government seeded, non-profit, industry/academia controlled underwriter should be established to provide stabilaztion to the rate structure.

3) Recognize an industry/academia formed and sponsored self-supporting "Underwriters Laboratory" equivalent, that would set commercial standards for space equipment and monitor quality assurance and reliability.

4) Reduce and/or remove barriers to U.S./Forgien cooperative efforts in commercial space ventures. To maximize the leverage of U.S launchers this legislation should allow for a two way flow of financial and technical resources. Enabling the U.S. launch industry to strengthen its position in the world market, through joint venturing and pooling of resources. This legislation should provide for monitoring of these exchanges, to ensure the peaceful use of said resources.

Commercial Launch Industry:

The commercial Launch Industry in the United States has been stifled by an embedded misconception that only NASA can place payloads into orbit successfully. The Commercial Launch Industry can only become successful, if it can reach out to do so, with out having its hands cut off by Big-brother. To support itself the launch industry must, in cooperation with the commercial space community:

1) Develop a business base using current launch vehicles. After establishing itself as a reliable provider of space acess, it must cooperate with the user community to develop new generation vericles that will continue to support the the commercial sector. These vehicles will have to provide increased capability, efficiency and reliability.

2) Support an independent organization that can promote commercial space activity, monitor industry activity and set standards of performance and compliance, serve as a nucleous and incubator for cooperative commercial space ventures, and establish a global network for the exchange of ideas and

information on new avenues of business.

Because of the current lack of launch capabilities and the realization that low priority payloads will be grounded into the 1990s, industry has pulled its backing and financial support from a number of research and development efforts. Even NASA funded, Centers for the Commercial Develoment of Space, are having a hard time attracting industrial support and participation. Only a reliable commercial launch capability will renew industrial support in space exploration.

NASA's current operating strategy is the largest single stumbling block to the development of the Commercial Launch Industry and it is costing the taxpayer untold millions of dollars annually, due to the lack of competition. The availability of a variety of launch vehicle designs and manufacturers will give NASA the leverage necessary to drive down the cost of space exploration. NASA must be rededicated to support the total effort of space exploration and not openly compete with the commercial sector it was intended to support. If NASA is allowed to continue masquerading as a commercial enterprise it will bankrupt itself and put commercial launch efforts, in the United States, years behind forgien competition. At this point NASA should be transitioning out of shuttle technology and developing the next generation of spacraft and spacehabitats. New shuttles should be built and operated by industry on a commercial basis. We currently cannot get manned craft beyond earth orbit, yet 18 years ago we were walking on the moon regularly. Why are we now lead to believe that less capability is a technological advance? Industry and Academia have always been supportive of NASA as their leader in space research and development and the are willing to renew that support if, NASA is directed to resume its intended role.

By placing all of our eggs into one basket we have severly limited the defensive positon of the United States. We do not depend on Navy or Air Force vehicles alone, to support wartime operations, the Merchant Marine and Civil Air Reserve Fleet have been developed. Yet all of our space transportation requirements, are to be provided by one government agency from limited facilities, with no commecial backup. The development of a strong Commercial Launch Industry in the United States, is imparative to our national defense and the security of the free world.

The commercial development of space will change the course of commerce unlike any other single event in recent times. The country that has the strongest commercial space industry will take the lead in international commerce. Over the next ten to fifteen years the Commercial Launch Industry will grow into a multi-billion dollar, world wide industry, with or without U.S. participation. With France and China already offering launch services and Japan establishing a strong commerical capability, it can only be expected that the Soviet Union will offer Commercial Launch Services shortly. With the Soviets' expertise and proven success in placing payloads of all sizes into orbit, their entrance into the marketplace will be a severe blow to the U.S. industry, unless we are there first.

If Congress fails to act now, in support of the Commercial Launch Industry, the United States' technological lead in the world market will be greatly reduced and the cost of regaining that lead will eventually become cost prohibative.

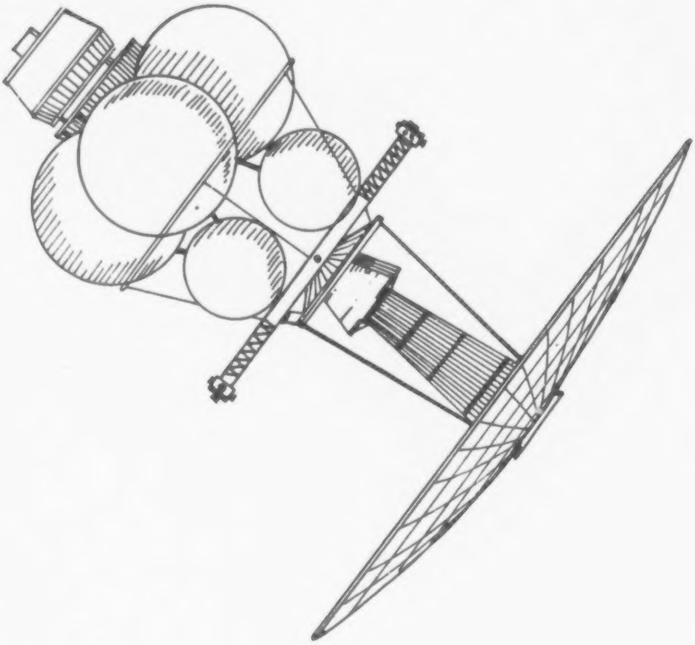
Thank You,

ROBERT L. STRAITT
Director

August 19 1986
Kermit A. Morris Jr
- Notary Public
- My Commission Expires
- May 28, 1987

DEVELOPING A U.S. ELV CAPABILITY -
APPENDIX #7

COMMERCIAL SPACE INCENTIVES ACT



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SUMMARY OF THE COMMERCIAL SPACE INCENTIVES ACT

Rebuilding the Dream

The purpose of the Commercial Space Incentives Act is to make the United States a spacefaring nation as President John F. Kennedy promised in 1961. "Spacefaring" means that private citizens of the United States should have practical opportunities for access to space for themselves or for their experiments and equipment. Space travel should be as accessible to Americans as air travel is today.

The Act is intended to stimulate private enterprise to develop low cost space launch capabilities without having to compete with government space launch systems.

How It Would Work

The heart of the Act is its incentive structure, under which the United States would guarantee, every year for the next ten years, to pay $500 per pound for the first one million pounds of payload placed in orbit by private U.S. companies. The minimum weight for an orbital payload would be ten thousand pounds.

It works this way: When a launch services company believes it can put 10,000 pounds or more into orbit and does not have a private sector customer for that launch, it notifies the Secretary of Commerce not less than six months in advance of the scheduled launch date. The Secretary passes word of the launch opportunity to all government agencies. If no government agency can take advantage of the launch opportunity, then the launch services company can contract with any private U.S. firm for the launch of any payload.

If a launch services company has a private U.S. firm as a customer for a payload, and if payment of at least $500 per pound of payload is made, then the United States government would have no further obligations regarding that launch. If the payment is less than $500 per pound, then the government would pay the difference between $500 per pound and the actual payment, provided the payload is successfully placed in orbit.

If no payload is available from the government and if no private firm steps forward with a payload to launch, then the launch services company can launch any legal payload it cares to send up. For example, under these circumstances water would be an acceptable payload. The United States government would pay $500 per pound if and only if such a payload were placed in orbit. The government would have no financial obligation if for any reason the payload were not placed in orbit. Under the provisions of the proposed Act, the government would pay ONLY for success in launching payloads into space.

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Advantages to the United States

The United States derives no apparent benefit from sand or water in orbit. But the people of the United States gain great benefits from the availability of launch systems that can put a five ton payload into orbit at a cost of $500 or less per pound. This is an important distinction, because the purpose of the Act is not to put payloads into orbit. Rather, its purpose is to provide incentives for private companies to develop this capability and demonstrate its success.

Clearly, no one wants to entrust a valuable satellite or other payload to a launch services company with no track record of performance. But it is most likely that only new, untried companies with new, untried launch systems will be able to bring launch costs down to $500 or less per pound. The Act guarantees that a new, untried company or launch system will have a chance to be tried and tested with a minimum of risk. If the new system succeeds only in putting water into orbit, then the launch services company gets paid for that launch while also demonstrating to potential customers that it can perform successfully. But if the launch fails, the company doesn't get paid. This is an incentive for the company to build quality and reliability into its system in the first place. The Act would not reward sloppy work.

The Numbers

Here is how the proposed numbers for the Act were derived:

* One million pounds is about the amount of material the Soviet Union launches every year.

* Five hundred dollars per pound is about 10% of NASA's present real costs. Analysts have estimated that many new space based industrial processes will become profitable once launch costs are reduced to this level.

* Ten thousand pounds is a useful weight for scientific, commercial, or military payloads. It guarantees that the United States will develop the ability to do many large scale and useful things in space at relatively low costs.

These numbers will ensure the development of regular and routine access to space. It would take a hundred launches of 10,000 pound payloads to meet the guaranteed lower limit of 1,000,000 pounds per year (fewer if the payloads are heavier; but the ability to launch heavier payloads is also a valuable national asset).

Ten years is enough time. If the Act hasn't done its job by then, it probably never will.

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Regulation

Payloads certainly should be inspected for the sake of public safety. And it's clear that private companies should not be allowed to launch spacecraft that would endanger life or property. Space vehicles are in fact less hazardous that large aircraft; nevertheless, they should be inspected, but only to ensure that they constitute no unreasonable potential hazard. The government's business is not to determine whether the technical approach used in a new launch vehicle system will work -- only to determine whether the system might fail dangerously.

Potential

At least three private engineering/development companies have stated their intention to develop new launch systems and compete for payments under the proposed Act. The potential benefits are enormous. The potential costs are fixed and relatively small. If the provisions of the Act are not implemented, the Act costs us little or nothing.

Something Like This Worked Before

The proposed Commercial Space Incentives Act is based on other very successful government incentives for the development of high technology transportation systems: for example, the Pacific Railroad Act of 1862 and the Kelly Bill of 1925. And some of its features resemble the Military Airlift Command's ability to contract for private commercial air transportation.

The Kelly Bill was enacted in 1925 to "encourage commercial aviation and authorize the Postmaster General to contract for airmail service." Up until then the United States lagged far behind the rest of the world in developing commercial aviation, and the Post Office itself was trying to fly the mail. Within a year after starting in 1919, the Post Office had lost 31 of its first 40 pilots. But within two months after its passage the Kelly Bill (which authorized payment to the airmail carriers of up to 80% of the mail revenues) had resulted in more than 5000 license applications by fledgling airlines. The entire United States air transportation industry -- the largest in the world -- owes its existence to the Kelly Bill.

Why It May Work Now

Today, the major fetter on the development of the private launch services industry transportation. Many studies have shown that private operations could reduce payload launch costs by a factor of at least five. Instead, the problem is that the infant private space launch industry cannot get financing or venture capital backing, because the financiers cannot see a market for private launch services in competition with heavily subsidized launches provided by the government.

The primary purpose of the Commercial Space Incentives Act is to provide a guaranteed government market for the critical first ten years of the private launch services industry. But instead of providing a subsidy, the government would buy only performance and success.

The Commercial Space Incentives Act lets the government shift space transportation services to private launch companies at minimal cost (in fact, at no cost if the services aren't successful) and with a minimal effect on existing government space transportation vehicles and organizations.

The short term and long term solutions to the problem of building an effective American space transportation system depend directly on our use of free enterprise. Certainly the policies of the last twenty-five years haven't worked. The Commercial Space Incentives Act would secure for the United States the opportunity to apply free enterprise to the problem. This approach worked sixty years ago in the air. We should give it the chance to work today in space.

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AN ACT

To facilitate private commercial space launches.

Be it enacted by the Senate and the House of Representatives of the United States of America in Congress assembled,

SHORT TITLE

Section 1. This Act may be cited as the "Commercial Space Incentive Act."

FINDINGS

Sec. 2. The Congress finds and declares that --

(1) the private sector in the United States has the capability to develop satellite launching and associated space launch services that would be useful to the United States Government;

(2) the development and operation of private commercial space launch vehicles and services would enable the United States to retain its competitive position internationally, thereby contributing to the national interest and economic well-being of the United States;

(3) the development and operation of private commercial space launch vehicles and services would assist the United States in maintaining space activities related to the purposes and functions of various agencies of the United States government in the areas of scientific research and development, the exploration of space, national defense, and meteorological services;

(4) the development and operation of private launch vehicles and services would be encouraged by the guaranteed use of these services by the United States Government, thus providing financial incentives for private investment in ventures leading to low-cost and high-reliablity space services.

PURPOSES

Sec. 3. It is therefore the purpose of this Act --

(1) to promote economic growth, private investment, and entrepreneurial activity in the areas of private space launch vehicle development and operation and private space services;

(2) to encourage the United States private sector to provide launch vehicle and other services to the United States Government;

(3) to require and permit the United States Government to avail itself of low-cost, high-reliability private space launch vehicles, facilities, and services.

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DEFINITIONS

Sec. 4. The following definitions shall apply to terms used in this Act --

(a) "Launch Services" shall mean the launch of payloads for military, scientific, civil and commercial purposes into space in orbits around the Earth and to and around the Moon and other celestial bodies.

(b) "Manned launch" shall mean any launch service that includes the carriage of at least one human being into space and that being's subsequent safe return to the Earth.

(c) "Qualified vendor" shall mean any United States citizen or any partnership, joint venture, business association or corporation controlled and owned by U.S. citizens.

GENERAL RESPONSIBILITIES

Sec. 5. (a) The Secretary of Commerce shall be responsible for carrying out the provisions of this Act, and in doing so shall --

(1) encourage, facilitate, and promote commercial space launches and activities by the private sector;

(2) consult and co-operate with other agencies of the United States Government with regard to licensing and other regulatory matters;

(3) receive and disburse the guaranteed space launch payload funds established by this Act.

(b) To the extent permitted by law, Federal agencies shall assist the Secretary, as necessary, in carrying out this Act.

SPACE INCENTIVE TRUST FUND

Sec 6. (a) A Space Incentive Trust fund ("the Trust") is established to be administered by the Secretary of Commerce ("the Secretary").

(b) Five hundred million dollars ($500,000,000.00) is authorized and appropriated to the Trust for the fiscal year 1987.

(c) Suitable funds shall be approproated each fiscal year to ensure that the Trust has adequate funds to satisfy payments for the payload weight guaranteed by the government as stated elsewhere in this Act.

(d) No funds shall be paid under this Act except from the Trust.

(e) At the end of fiscal year 1997, any funds remaining in the Trust shall be returned to the general fund of the U.S. Treasury and this Act shall expire.

GUARANTEED USE OF SPACE LAUNCH SERVICES

Sec. 7. (a) The Secretary shall offer to purchase for the use of the United States Government each fiscal year one million (1,000,000) pounds of payload placed in space by private launch services.

(b) The minimum payload weight the Secretary is authorized to offer to purchase and/or to pay for is ten thousand (10,000) pounds.

(c) The Secretary shall ascertain that all Federal agencies shall have availed themselves of the launch services of qualified vendors before said agencies may place such payloads in space on government launch vehicles. However, a space payload may be flown by a government space vehicle if at the time of the intended launch no qualified vendor is capable of placing a payload of the required size or weight into the required orbit or trajectory.

(d) The Department of Defense shall not be required to utilize any of the United States Government's guaranteed annual payload requirement offered by a qualified vendors if, in the opinion of the Secretary of Defense, suitable safeguards relating to national security cannot be maintained.

PAYMENT FOR SERVICES

Sec. 8. (a) The Secretary shall authorize for payment all or part of the funds of this Act to a qualified vendor of space launch services who performs in accordance with this Act.

(b) The Secretary shall pay funds in the Trust to any qualified vendor who successfully performs launch services on a first-come, first-paid basis, at the rate of $500 per pound of payload placed in orbit.

(c) If a successful launch service is a manned launch, then a supplement of an additional $250 per pound shall be paid by the Secretary from the Trust to the qualfied vendor.

(d) No funds shall be paid from the Trust until and unless the launch service is successfully performed. In the event that the qualified vendor fails to place the payload in orbit in space, no monies shall be paid to the qualified vendor. It shall be the responsibility of the qualified vendor to prove to the satisfaction of the Secretary that the payload was placed in orbit, and the qualified vendor may utilize the facilities of the United States government to do this at his expense, the cost to be determined by the General Accounting Office.

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(e) If the Secretary refuses to accept the launch service or abandons the launch service due to delay or otherwise, then the qualified vendor shall be free to launch any payload with the tendered launch service. If the qualified vendor sells the launch service to a non-government party before or after refusal or abandonment of said service by the Secretary, and if the non-government party pays less than $500 per pound for the launch service, the Secretary shall be responsible for payment of the difference to the qualified vendor. If the payload is successfully launched, regardless of who the launch service customer may be, then payment shall be made to the qualified vendor as provided for by this Act.

TENDERING OF LAUNCH SERVICES

Sec. 9 (a) A qualified vendor shall tender launch services to the Secretary at least six months before the proposed launch date.

(b) A qualified vendor may use the services of the National Space launch ranges of the United States on a first-come, first-served basis, at actual cost, as determined by the General Accounting Office.

(c) Either the qualified vendor or the Secretary may delay the launch date by up to 90 days without penalty. The Secretary may delay longer than 90 days by paying liquidated damages of 1% of the launch cost from the Trust to the qualified vendor for each day of additional delay, or part thereof.

(d) The only review required for launch of any payload launched under this Act shall be the mission safety review required by the Commercial Space Launch Act of 1984, as administered under the regulations promulgated by the Department of Transportation.

CITIZENS ADVISORY COUNCIL ON NATIONAL SPACE POLICY

EXECUTIVE SUMMARY

SPRING '86

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CITIZENS ADVISORY COUNCIL ON
NATIONAL SPACE POLICY
J. E. Pournelle, Ph.D., Chairman
EXECUTIVE SUMMARY
Spring 1986 meeting
May 9-11, 1986

THE CRISIS

The space program has been America's pride and enduring symbol of technical championship. Because of the apparent collapse of that program we seem to face a three-fold national emergency.

The national emergency is real enough; but it was not in fact caused by the Challenger disaster. Challenger has illuminated the nature of the emergency; but we would be faced with a crisis situation even if NASA's Challenger and Delta, and the Air Force's two Titans, had performed flawlessly; and even if we replaced Challenger five times over, the triple threats would remain.

We face a military crisis, an economic crisis, and a spiritual crisis.

The Military Crisis --

Alfred Thayer Mahan's "The Influence of Sea Power Upon History" was a key work in American thought. It demonstrated something that should have been obvious, but wasn't until Mahan said it: without access to the world's oceans the United States could never be a global power.

Without access to space the United States cannot be a global power. Recognition of this simple fact leads to an important conclusion: we must never be dependent on any single system for access to space.

Shuttle is not enough. One Stinger missile fired at our only Shuttle Carrier Aircraft; one fire in the Vertical Assembly Building; and the Shuttle fleet is crippled. These are not the only single point vulnerabilities of the Shuttle fleet.

Shuttle augmented with an emergency program of expendable systems is still not enough. Military access to space implies more than the spectacular events space launches have become. Military access must be routine and operational, performed on demand with the troops available and on watch, not with a tiny group of highly trained specialists. Astronauts, like test pilots, show the way and take the extraordinary early risks; but all missions cannot be flown by test pilots.

Without access to space, our wonderful dream of strategic defense is gone, and we return to the nuclear nightmare. Until we have routine and operational access to space, our armed forces can be blinded at another's will, our strategic defenses can be negated, and we have no assurance that we can remain a global power.

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The Economic Crisis --

The economic crisis is not as acute as the military threat, but over the long run it will be no less severe.

This isn't the place to look at the long term economic benefits of access to space. The short term consequences of the Challenger disaster are obvious enough. The rush to Ariane has begun, because business depends on space for communications as well as information. In a particularly humiliating development, the two satellites Discovery so proudly recovered from orbit may be launched by the Long March Rocket built by a Red Chinese refrigerator company.

We can survive all that. The real difficulty is that the great promise of the space environment has been eaten by the enormous costs of access to it. Commercial companies, like the military, cannot depend on costly spectaculars. Real commercial space developments cannot proceed until entrepreneurs are assured timely and routine access to space at reasonable costs.

Neither new Shuttles nor new Titans can give that access. At today's launch costs, even if someone developed a magic process using the space environment to turn lead into gold, there would be no profit in sending lead out there.

The vast resources of the Solar System lay just beyond our grasp; until we have affordable access to space we cannot reach them.

The Spiritual Crisis --

Nations die in spirit long before their resources are expended. Where there is no vision, the people perish. Where there is no frontier, democracies die.

In 1979 an American President told the American people that we suffered from a national malaise; that the era of growth was ended; that we had come to the limits to growth, and we must learn to make do with less; in a word, that the frontier was closed. In 1980 the American people decisively rejected that message.

Americans want no limits; but without a frontier the limits are very real. We have not reached those limits, and in this generation we will not; but eventually those restricted to a single planet will find their dreams shattered and their future bleak.

That need not be, for we have an open frontier. In a very real sense, space is an endless frontier. Until recently our young people believed that.

Now come the doubts. Challenger died in fire and smoke as the youth of a nation watched. If we do nothing, we will find that a great deal more than the Challenger Seven died last January 28. We have lost Challenger. We cannot lose our pride as well.

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We can rebuild Challenger; but when we have done so, the spiritual crisis will remain. Shuttle will never be our road to the frontier. Like the China Clipper, Shuttle is a glorious dream; but it is a dream for the few, something to be experienced in books and movies and on television. Shuttle can never be access to space for Americans. The American frontier was opened by covered wagons, not by first class tickets on clipper ships.

If we are to restore the dream, we must let every American dream: access to space should be as easy as buying a ticket on a Greyhound Bus.

A Spacefaring Nation --

In 1962 President John F. Kennedy pledged that America would become a spacefaring nation.

We have not fulfilled that pledge.

We are a seafaring nation. Any American can realistically dream of sea travel. We are an airfaring nation. Any American can realistically dream of air travel. We will not be a spacefaring nation until any American can realistically dream of going to space.

Spacefaring nations have space navies, space factories, space miners exploiting space resources; space hotels, and space tourists. A real spacefaring nation would have a Hilton on the Moon, and a lively debate about whether to allow a McDonald's to open within a mile of Neil Armstrong's first footprint.

The Way Out --

The triple threat is real enough, but no crisis was ever more easily avoided. Access to space will restore national pride, open the frontier, inspire our entrepreneurs, and let us continue as a global power.

We must, however, recognize the real problem, and avoid the expensive quick fixes that eat out our substance without giving us either liberty or safety. In particular: the American people want a new Shuttle to replace Challenger. Perhaps they should have it. A new Shuttle can help get us through the current crisis, and help to restore faith and pride; but it will not give us access to space. One or half a dozen new Shuttles will not give the American people access to space any more than building half a dozen new China Clipper flying boats in 1936 would have given the American people access to China; and compared to Shuttle, the China Clipper was cheap.

The triple threat does not end until we are a spacefaring nation: until we have military, commercial, and citizen access to the endless frontier. The triple threat does not end until access to space is as simple, routine, and cheap as access to high altitude is today.

But How? --

It is simple enough to say that we must have routine and economical access to space; but how can that be accomplished?

First: it will not be done by "business as usual." We can fix up Titan and Shuttle and buy new copies of both, and we will still be no further than we were in December of 1985; and we were far behind then. In fact, no conceivable increase in the NASA budget will yield routine and economical access to space for the American people.

Second: economical and routine access to space is neither economically nor technically impossible. We have made it expensive, but it need not be so. We need only refrain from erecting multitudes of new offices and staffing them with swarms of officers who harass the people and eat out their substance.

For example, Max Hunter took the Thor missile from contract to an operational wing in under three years. It was designed for launch by a crew of eight. Since then Thor has grown into NASA's Delta, requiring a staff of more than 1200 to launch fewer than a dozen birds each year. Hunter didn't need that many to design and build the missile from scratch.

The SR-71 aircraft was developed by Kelly Johnson and his "Skunk Works". It took fewer than four years. Polaris went from contract to operations in the same time. In 1942 Enrico Fermi demonstrated the first self-sustaining nuclear reaction. In 1945 we detonated the first atomic bomb.

On May 25, 1961, John F. Kennedy committed this nation to land on the Moon within the decade. Apollo displaced Overlord as the largest and most complex single project in the history of mankind; and in July, 1969, Neil Armstrong made his one giant leap.

This nation can make giant leaps; but we can also convince ourselves that it is impossible. In 1979 Dr. Robert Frosch, Administrator of NASA, told a group of scientists that the United States could not possibly return to the Moon in under ten years. Recently the best people in government recommended a five billion dollar Band-Aid for our space launch crisis. This amazing state of affairs will continue as long as we listen only to NASA, for most NASA officials believe we have no choices: we must continue buying the mixture as before, no matter how high the price.

They tell the truth as they see it, but it is nonsense. NASA was magnificent in its day, but it is now the problem, not the solution. NASA became the problem the day its mission changed from development science to Shuttle operations. Government railroads and airlines are notoriously inefficient. Why did anyone suppose that NASA Shuttles would do better?

If the only US airline were operated by the government, and sent up no more than a dozen airplanes a year, we would be told that airplane flight can never be cheap enough for private citizens; but the reality is something different. Today we are told that space flight can never be cheap enough for private citizens. As long as government regulations mandate a government monopoly that will be true; but no law of nature or economics requires it.

Our crisis is real enough, but it is self imposed; we have only to recognize the nature of the crisis and it will be solved.

WHAT MUST BE DONE?

Above all we must recognize the nature of the crisis. The nation must understand, once and for all, that the goal is not access to space for an elite few, but for all Americans, and indeed for all mankind. Given that understanding we can proceed.

Shuttle: The Present Fleet --

The Shuttle is safer in 1986 than it was in 1985. We do not need an expensive redesign coupled with a year's delay. We should begin to fly our remaining Shuttles well before the end of 1986.

Prudence dictates changes in procedure. The first is simple: make no attempt to recover the Shuttle "Recoverable" Boosters. When the solids are assembled, seal the joints permanently, if possible, and let them splash to be claimed as salvage by anyone who wants them. This isn't even expensive: the "recoverable" feature of the boosters always was more for political than economic advantage. Not sending the recovery fleet saves time and money; the additional costs of new boosters will be small compared to the cost of redesigning them to be safely recoverable. Splash them and forget them.

The important thing is that we get our Shuttles flying again. If we wait, study, gold plate each part, and wait again, we will not only add inordinately to launch costs, but actually increase the dangers as crew experience fades and experienced technicians are laid off or take other jobs. We should fly Shuttle before the end of 1986; preferably this Summer. We should take due care in future launches; but we must launch.

Shuttle: A New Orbiter? --

We have noted that the American people want a new Shuttle orbiter. There are advantages to giving it to them. For all its faults, Shuttle is the only large payload system we have at present. A new orbiter is insurance against more rapid than expected deterioration of the fleet -- or, God forbid, the loss of another Shuttle.

If we buy a new orbiter, we must avoid two potentially disastrous errors. First, a new Shuttle must not be allowed to eat up the budget that might go to development of new and more efficient vehicles.

The second danger is more insidious.

Reasonable changes in our procurement procedures will allow us to buy two, and possibly three, new Shuttles for little more than the cost of a single orbiter. Indeed, intelligent management that insists on functional rather than exact equivalence of Shuttle subsystems will likely be able to buy three orbiters for less than the quoted price of a single replacement for Challenger!

The danger is that these cost reductions will succeed; and we will then believe that we have successfully found our way out of our national emergency.

The truth is that even if someone gave us a dozen new Shuttles free and clear, we could not afford to operate them. Shuttle will never be the American people's Greyhound Bus, nor will it ever be the vehicle the military needs to secure access to space. Beautiful as it is, Shuttle remains a China Clipper.

The Military Crisis --

Once we recognize the nature of the problem, the first part of the solution becomes obvious: the military must be ordered to secure our access to space.

This does not mean a charge with bayonets, or indeed any violent activity. It does mean that the military must be told to be serious about securing access to space. Specifically, each service must be ordered, by the Commander in Chief and at a high enough level that the responsibility cannot be avoided, to develop a strategy for assuring access to space. Protests that the mission is not wanted, or that insufficient resources have been provided, must be met with the words of the West Point Tactical Officer: "Shut up and soldier."

Providing assured access to space means defending our citizens and their property in space. It means search and rescue. It means military men performing military missions in orbit, for all the same reasons that sailors venture into the ocean depths and pilots command the skies. Most importantly, it means routine military launch operations, with payloads handled by loadmasters, not engineers, and with daily scheduled launches, not monthly spectaculars.

Military space strategy and operational doctrines must be developed in the same way as any other military mission requirements. The estimate of the situation should include recommendations on what resources must be committed to the mission, and what probabilities of success can be expected with less than optimum resource commitments.

The important point is that the mission must not be avoided whether wanted or not, and whether or not "enough" resources are devoted to the job.

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The Commercial Crisis --

A thirty billion dollar NASA budget is unthinkable, but a thirty billion dollar corporation is another member of the Fortune Fifty.

Access to space for all Americans will only be assured by free enterprise; but the current high costs of space access keep our private companies from developing space products. This vicious cycle must be broken. Fortunately it can be.

The first step is to remove the government anchors which hold back development of private launch capability. We do not argue that the public has no interest in regulation of space hardware; but we do argue that the public also has a great interest in letting that hardware be developed. Public safety must be protected, but government regulation of space must be like the FAA, not the unlamented CAB.

Secondly, government can provide incentives, much like those given the early aviation industry with Air Mail contracts.

Specifically, we recommend immediate passage of a Commercial Space Incentives Act. Under this Act, the government would guarantee to pay transportation costs of $500 a pound for one million pounds placed in orbit each year. The Act would continue for ten years, then expire. Thus the total cost of the Act would be $5 billion, plus the costs of administration.

These numbers are not cast in stone. One million pounds is about what the Soviets launch every year. Five hundred dollars per pound was chosen because this is about 10% of what it costs NASA at present. Ten years was chosen as a not unreasonable time limit: if this Act has not done its job in ten years, it probably never will.

In practice the Act would probably cost much less than five billion dollars.

It works this way. A private company develops, at its own cost, the capability to place some minimum mass--say ten thousand pounds -- into permanent Low Earth Orbit. Once the capability exists, the company schedules a launch, and notifies the Secretary of Commerce approximately six months in advance. If any department of government has a payload to be placed in an orbit achievable by the launching company, the payload is given to the company.

If the government has no satellite for launching, the Company is free to advertise its capability; to contract with any US company to place their payload in orbit; and to collect any fee mutually agreed on. If that fee is equal to or greater than $500 per pound, the government has no obligations. If less, the government will pay the difference.

If neither government nor commercial enterprise has a suitable payload, the Company may furnish its own. The payload may be anything: a satellite, raw materials for construction, fuel, water, or even sand. The government has no requirement to furnish a payload for what it believes is a non-existent capability; but must pay $500/pound for any pounds actually put into orbit. There is no obligation to pay for failed launches.

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At worst this Act does nothing; but since NASA at present spends a great deal more than $500 per pound to put payload into Low Earth Orbit, this Act has the potential to give the government access to space at much lower than present costs.

A combination of regulatory reform and reasonable incentives will finally unleash the engines of free enterprise in space. After that, access to space will be secure.

The Spiritual Crisis —

Like the military and economic crises, the spiritual crisis is solved by routine and economical access to space. In a real sense, though, the solution is simpler than that. Recognition that getting to space through extraordinary means is not the solution is in itself the solution to our problem.

We do not have routine access to space because we believe we can't do it. Our spiritual crisis is caused by a failure of will, and that failure of will is the spiritual crisis. We have only to recognize this and the crisis will go away.

This sounds like witchcraft or faith healing. It is neither.

In 1979 the world faced an energy crisis so severe that the United States, in a symbolic gesture, decorated but did not light the White House Christmas Tree. The limits to growth were upon us: we were all asked to conserve. Large sums were invested in research on synthetic fuels. Despite these and other desperate measures, senior officials of the Department of Energy repeatedly said that the energy crisis would not be solved for at least a decade; and ever more repressive regulations were needed to redistribute our scarce energy resources.

In 1981 a new administration deregulated the energy industry. By 1986 oil prices had fallen to about where they were before the OPEC cartel was formed.

In 1982 few believed that strategic defenses were possible. On March 23, 1983, President Reagan challenged the US scientific community to find ways to defend the nation. By 1986 scientists and engineers had found multiple ways for defending the nation; and while strategic defense has not won universal acceptance in the scientific community, a great number of important scientists have been converted. The nation continues to move toward a day when nuclear weapons will be impotent and obsolete.

In 1980 American embassy personnel were held hostage by the Iranians, and a rescue attempt by the US military ended in humiliation and failure. The US military was perceived as incompetent. By 1986 the Grenada operation, the interception of terrorists on the Egyptian airliner, and the Libya raids proved otherwise.

In 1979 inflation hovered near 20%, and it was conventional wisdom that any attempt to combat inflation while reducing unemployment would violate the fundamental principles of economics. In 1986 consumer prices continue to fall.

In each of those cases the crisis was caused by a failure of will, and the solution was no more -- and no less -- than bold leadership to unleash the natural energies of the American military, economy, and people.

It is true that many experts say that it is impossible to reduce launch costs by a factor of ten. Experts also said that control of inflation is impossible; that the oil crisis was permanent; that we cannot escape the limits to growth. Experts said that the ICBM and atomic bombs were impossible. It is not that experts are always wrong; but as Arthur C. Clarke observes, when a venerable scientist tells you that you can't do something, he is usually wrong.

TWO YEARS

First aid students learn the order of treatment: bleeding, breathing, poison, shock.

The United States is bleeding. We face no immediate threat of extinction, but we do not forget the flames of our launch failures. Meanwhile we hold our collective breath, waiting--and we are offered a year's delay and a five billion dollar price tag

We have been poisoned. The poison is the high cost of access to the endless frontier. It is self-administered.

We suffer from the shock of self-doubt and the failure of national will.

Two years can change all that. Within two years the United States cannot only have cured the bloody wounds of the Challenger disaster, but be well along the way to throwing off the poison of the high cost of space access.

Given that, the shock of self-doubt will automatically be cured.

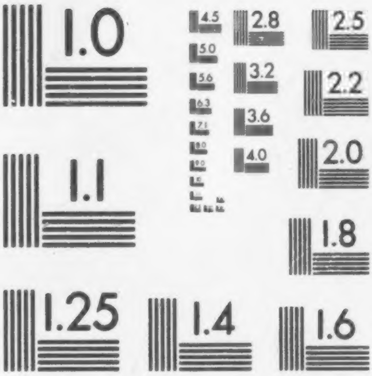
The alternative is grim. If we have no assured access to space the Strategic Defense Initiative fails. We will lose the dream that ICBM's may someday become impotent and obsolete; we will return to the MAD nightmare. If we do not have, and will not have routine access to space for all, we will lose the dream of a frontier open to all. We will return to the nightmare of "national malaise" and the era of limits.

It need not be. Two years is not enough time to give everyone access to space; but two years is more than enough to give everyone hope of space access. Two years is more than enough to assure us that we will, at long last, fulfill John Kennedy's promise and become a spacefaring nation. Two years of bold and vigorous leadership can place us so firmly on the road to real space access that we will never turn back.

As we said in the first meeting of this Council:

"The statesman who takes mankind permanently into space will be honored when Isabella the Great is long forgotten."

CENTIMETERS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